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## Cognitive functioning and Pain Experience in Patients with Vascular Dementia

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# Abstracts Presented at the Twenty-Sixth Annual International Neuropsychological Society Mid-Year Conference

**July 16–20, 2003**

**Berlin, Germany**

**Organized as a Joint Meeting with the German Society of Neuropsychology (GNP)**

**Wednesday Afternoon, July 16, 2003**

**Symposium 1/3:00–4:30 p.m.**

## **MULTIMODAL TREATMENT PROGRAMMES FOR DEMENTIA PATIENTS AND THEIR FAMILY CAREGIVERS**

**Organizer and Chair: Barbara Romero**

### **B. ROMERO. Multimodal Treatment Programmes for Dementia Patients and Their Family Caregivers.**

Interdisciplinary rehabilitation approaches that address somatic, psychiatric, functional and psychosocial aspects of illness are relevant to the treatment of multiple and progressive cognitive impairments and behavioural symptoms that result in high dependency. The most recent studies showed that these multimodal, interdisciplinary therapeutic interventions, combining pharmacological treatment for patients with rehabilitation interventions for patients and psychoeducational approaches for caregivers, are the most effective (Brodsky et al., 2002; Mittelman, 2002). In this symposium different centres will present their therapeutic programmes, which were developed most often as a clinical service. Results of evaluation studies will also be shown.

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### **M. WENZ & B. ROMERO. Alzheimer Therapy Centre Bad Aibling: Caregiver Intervention Integrated in a Treatment for Dementia Patients.**

The Alzheimer Therapy Centre (ATC) was founded in 1999 as a part of the Neurological Hospital Bad Aibling in co-operation with the Clinic and Polyclinic of Psychiatry and Psychotherapy of the Technical University of Munich. The therapy centre provides a four-week residential treatment programme. The intensive therapy adopts an interdisciplinary approach which is tailored to the individual in the light of the medical, neuropsychological and psychosocial assessment. The multimodal treatment programme incorporates three elements: (1) pharmacological treatment with anti-dementia, anti-psychotic and anti-depression drugs, (2) rehabilitation programme for patients, and (3) psychosocial support for caregivers. Caregiver interventions include an education programme in the form of individual and family sessions and support groups as well as psychotherapeutic support in individual sessions, art therapy, relaxation training and social work consultation. Our previous studies of the effectiveness of this treatment programme showed an improvement in well-being of caregivers in a

pre-post-design. In this presentation new results concerning caregivers' benefit from the treatment programme, including one year-follow-up will be presented.

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### **B. ROMERO & M. WENZ. Concept and Effectiveness of a Rehabilitation Programme for Dementia Patients.**

The rehabilitation programme provided in the Alzheimer Therapy Centre (ATC) Bad Aibling is based on the concept of self-maintenance therapy (SMT). This (neuro)psychological therapy was developed for AD patients (Romero & Eder, 1992; Romero, 1997) and targets the best possible activation of the patient's (currently) remaining cognitive and social skills. These remaining psychic reserves are organised into a system (the self-system) consisting of memories, beliefs, ideas, habits and expectations, and provide the foundation for action and experience. A stable self-system provides the necessary conditions for optimal use of the person's remaining resources. For people with dementia this means the maintenance of the current optimal level of everyday functioning and the reduction of avoidable behavioural difficulties and psychotic symptoms. The rehabilitation programme for patients includes art therapy, gymnastics, massage, relaxation, self-related knowledge training, everyday activities, listening to music and singing as well as different cultural and social activities. Therapists observe patients and give recommendations to caregivers, what kind of activities the patients prefer (or reject) and what kind of everyday support is necessary to compensate for lost competence. Our previous studies (Romero & Wenz, 2001, 2002) showed an improvement in well-being and a reduction of psychopathological symptoms in patients groups. In this presentation new results including one year follow up will be shown. Efficacy will be assessed in relation to the following domains: everyday living skills, more complex everyday activities and neuropsychiatric symptoms.

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### **S. URBAS. Art Therapy With Dementia Patients.**

Art therapy is a form of psychotherapy conducted through visual imagery. Art therapy can facilitate change even in the absence of verbal expression, and it can be used effectively even with people who have severe dementia. The process of painting, drawing or sculpting provides a space for individual expression and creative engagement with the self. Art therapy is concerned, not just with experiencing a fulfilling encounter with self in

action, but also with the satisfaction of our basic human need for active and successful engagement with the environment. These two cornerstones of quality of life are, in general, rarely experienced by people with Alzheimer's in their everyday life. It is the art therapist's task to offer a therapeutic space providing experiences that address these basic needs. This is achieved through sensitive understanding of individual resources and needs, strengths and preferences. In art therapy, it is possible to express ideas and feelings that cannot be conveyed in words. This is particularly important in the case of people with language impairments. This presentation, accompanied by patients' pictures, provides an insight into the varied possibilities of the therapeutic work.

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#### **R. SCHMID. Training for Caregivers of People With Dementia—A Randomised Study at the Memory Clinic Entlisberg Zürich.**

Since 1995 the Memory Clinic Entlisberg Zürich has offered training courses for caregivers of people with dementia. In these courses caregivers learn among others how to deal with their family members who suffer from dementia. Experience shows that after the training courses, caregivers have better strategies to deal with problems. They have better comprehension of the symptoms of dementia and in consequence treat their family members in a more adaptive and kindly way. They have less difficulties in accepting help and they extend their social life. To study the effects of the offered training, in autumn 2000 a scientific, randomised evaluation was started at the Memory Clinic Entlisberg. One hundred twenty couples (caregivers and patients) took part in the study. 60 of the caregivers were drawn to join the seminars. The others (control group) received a manual for a cognitive training for patients at home. Both groups will be observed over 4 years. One of the questions of the study is whether education can reduce the burden of caregivers. Among others this question is analysed by using the "contingent valuation method". With this method the value of products that have no market price and cannot be bought is measured. So people are asked, how much they would pay for a hypothetical treatment of dementia, if this treatment for example would not cure the disease but would reduce the burden of caregivers.

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#### **H. SCHAENZLE. Filling the Needs: Connecting Diagnosis, Counseling, and Therapy in Outpatient and Inpatient Setting.**

Memory Clinic Muensterlingen, part of the Psychiatric Clinic of the Kanton Thurgau in Switzerland, is a specialized Centre for diagnosis, counselling and therapy for cognitive impairment in the elderly. The possibility to combine these three bases in outpatient and inpatient setting helps to fill the needs of patients and their caregivers in different stages of dementia. Our clinical data underlines, that individual programs, possibility to change between out- and inpatient setting, counselling programs for the caregivers and special seminars, help to establish an individual and satisfying coping strategy. One of the most helpful bases is the thematically therapy program. At the symposium we present our program with its goal, to stabilize loss of self-oriented memory. Our data, based upon neuropsychological evaluation and follow up of development of our patients, shows that the thematically therapy program, containing cognitive, motor, creative, musical and daily skills training, has its positive effect on communication, affect and social skills of the patients. In addition, the positive effect on caregiver burden will be shown.

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#### **M. WENZ. Psychotherapy With Family Caregivers of Dementia Patients.**

In recent years psychoeducational programmes and self-help-groups have been developed to provide family caregivers with techniques and strategies to handle behaviour problems of dementia patients and to give them

emotional support. All these approaches are group-based and have helped to improve the situation of family caregivers considerably. Psychotherapy in a single setting offers further possibilities beyond psychoeducation to address special emotional problems more individually. In this presentation our first experiences with psychotherapeutic support for caregivers, based on cognitive behaviour therapy and systemic therapy will be presented. Emotional problems like feelings of depression, grief, loss, anger, aggression, self-blame and guilt will be addressed. Also dysfunctional cognitive and behavioural coping styles will be outlined. Intervention techniques to deal with these cognitive and emotional problems will be suggested. The importance of social support and external help to get relief from the caregiver role is stressed and strategies to motivate caregivers to seek for help will be presented. Different modules of the therapy programme include relaxation training, psychoeducation, behaviour analysis of problem situations, cognitive and emotional techniques to deal with these situations, role plays, motivational strategies, activity planning, biography work and working with grief and loss.

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### **Symposium 2/3:00–4:30 p.m.**

## **EMOTIONAL PROCESSING OF FACES**

### **Organizer and Chair: Katja Werheid**

#### **K. WERHEID. Emotional Processing of Faces.**

In the past few years, emotional processing has become an increasingly important topic of neuropsychological research. Many studies on emotion have focused on face processing, as human faces are among the most salient emotional stimuli in everyday life, conveying a large variety of social signals. The interaction between cognitive and emotional processing of faces is an ongoing matter of debate, as well as the question whether processing of faces is distinct from processing of other types of emotional information. The present symposium attempts to provide a platform for different approaches to investigate the topic. Empirical evidence from a broad variety of neuroscientific methods is gathered, including the measurement of reaction times and event-related potentials (Wild-Wall et al., Werheid et al., Schupp et al.), functional imaging of the healthy brain (Sammer et al.), and clinical research with different patient groups (Sprengelmeyer, Suslow et al.). At the same time, different dimensions of emotional processing will be considered, as processing of facial affect, attractiveness and likability. Evidence for automatic processing will be reported (Schupp et al., Suslow et al., Werheid et al.), and the dissociability or interaction of emotional and cognitive face processing will be addressed (Sprengelmeyer, Wild-Wall et al., Sammer et al.). Taken together, the symposium gives an overview of the current research and discussions within the field of emotional face processing.

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#### **G. SAMMER, A. STRÜCKER, P. KIRSCH, & D. VAITL. Effects of Attractiveness and Priming on Face Processing as Revealed by fMRI.**

Little is known about how the brain represents facial attractiveness. Gaze direction and reward value of faces modulate brain activation patterns. Particularly the dopaminergic reward system is supposed to be involved in the facilitation of face recognition by attractiveness. However, this system does not play a major role in priming, which also facilitates face processing. The aim of the present study was to investigate if there is an interaction between perceived face attractiveness and repetition priming. After memorizing three sequentially presented faces, a single probe-face was displayed, which was or was not one of the faces shown before. Each probe was slowly unmasked. BOLD-recording benefits from the prolongation of stimulus processing. Subjects ( $n = 20$ ) indicated by a button

press if the face belonged to the to-be-memorized set or not. Totally, 120 trials like this were performed by each subject. Reaction times indicated the expected recognition facilitation. Primed faces showed a decreased activation in the fusiform gyrus. High-attractiveness of the individually rated faces activated structures in the mesolimbic dopaminergic system, and the limbic system including insula, parahippocampal area and the cingulate gyrus. Interactions of the factors attractiveness and priming were found in the limbic structures. Summarizing, based on Haxby's (2000) model of a neural system for face perception, priming takes place at the visual analysis modules, and attractiveness activates the extended modules of the model. However, priming modulates the attractiveness effects in the limbic system, which also belongs to the extended modules.

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**K. WERHEID, G. ALPAY, & W. SOMMER. Evidence for Dissociable Brain Responses to Facial Affect, Likeability, and Attractiveness.**

In this study, we investigated different aspects of automatic emotional face processing with a priming task and recording of event-related potentials (ERPs). In earlier research, priming effects have been shown for cognitive processing of faces, using stimulus pairs depicting the same person or a semantically related person. However, it has not been investigated whether different, but affectively related faces can prime each other, i.e., facilitate of the response to the second face. To explore whether affective priming effects can be found in healthy participants, reaction times and ERPs following pairs of unfamiliar faces were analyzed. We investigated three dimensions: facial affect (happy vs. angry), attractiveness, and likeability. All stimuli were selected individually according to participants' previous ratings. In the attractiveness and likeability conditions, stimuli with neutral facial expression were presented. During the experiment, participants performed dichotomous judgements according to each of the three dimensions in separate blocks. Our results show similar behavioral priming effects for all three dimensions. However, priming effects in ERPs differed considerably between the judgement of facial affect on the one hand, and attractiveness and likability on the other hand. Stimulus pairs depicting the same facial expression elicited an early frontocentral and a late bimodal positivity as compared to incongruent stimulus pairs. These priming effects did not depend on stimulus valence. In contrast, ERPs in the attractiveness and likeability conditions were strongly modulated by the valence of both prime and target faces. We conclude that different affective aspects of unfamiliar faces elicit dissociable neuronal response patterns in the brain.

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**H.T. SCHUPP, J. STOCKBURGER, J. BAHLMANN, A.I. WEIKE, & A.O. HAMM. Fear Captures Attention: The Processing of Threatening Facial Expressions.**

The present study tested the hypothesis that humans preferentially orient their attention towards threat. Accordingly, threatening, friendly, and neutral faces were presented while dense sensor event-related potentials were measured. The selective encoding of threatening pictures was analyzed while subjects either had no explicit task for emotional categorization of the faces (block 1) or performed an explicit non-emotional selective attention task (block 2). Assessing the initial stage of perceptual stimulus encoding, threatening faces elicited an enlarged posterior negativity compared to non-threatening neutral or friendly expressions. Moreover, facial threat also elicited augmented late positive potentials (LPP) relative to the other facial expressions, indexing a more elaborate post-sensory conceptual stimulus analysis. However, while subjects performed a selective attention task, the effect of selective processing of facial threat was only apparent for the early posterior negativity but not the LPP. An evolved fear module was recently proposed specifically tailored to solve adaptive problems prompted by danger. One characteristic of the fear module is the automatic activation by fear-relevant stimuli. The present data suggest that

threat elicits the cortical signature of selective attention at early visual and higher-order controlled mode of stimulus analysis. However, only the modulation of the early visual stimulus analysis appears automatically, i.e., it is observed even when subjects explicitly pursue non-emotional task-goals focused on other aspects of the stimuli. This effect may result from selective tuning of visual cortices to threatening information by the amygdala.

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**N. WILD-WALL & W. SOMMER. Interactions of Facial Familiarity and Emotional Expression: ERP Evidence.**

Previous research revealed that the recognition of facial expressions may not be independent of familiarity as postulated by traditional face recognition models. We attempted to localize these interactions within the information processing system. In Experiment 1 portraits were categorized according to emotional expressions (smile vs. disgust). Categorization was faster for portraits of personally familiar than for unfamiliar persons. The familiarity advantage was not due to differential expressiveness of the portraits because it disappeared in participants for whom all portraits were unfamiliar. In Experiment 2 event-related potentials (ERPs) were recorded in 16 participants during expression categorization. Performance replicated the results of Experiment 1. The latency of the P300 component of the ERP—reflecting stimulus categorization time—was unaffected by familiarity. The same held true for the interval between the onset of the lateralized readiness potential (LRP) and the response—reflecting the duration of motoric processes. In contrast, the interval between stimulus and LRP-onset—reflecting the duration of pre-motor processes—was shorter in familiar as compared to unfamiliar faces. The results imply a post-perceptual but pre-motoric locus of the facilitating effect of familiarity on expression categorization. In Experiment 3 participants performed familiarity decisions about portraits expressing different emotions. Preliminary results suggest an advantage of smiles over disgust for familiar but not for unfamiliar faces. The emotional expression advantage for familiarity decisions appears to be similarly localized as the familiarity advantage for expression decisions. The experiments indicate that familiarity and facial expression may not be independent processes.

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**R. SPRENGELMEYER. On Fear and Disgust Recognition.**

The ability to recognise the moods and feelings of other people is fundamental to skilled social interaction. Research on emotion recognition has placed particular emphasis on facial expressions of emotion, which are usually considered to have some form of privileged status. Studies of impairments of facial expression recognition have shown that they can dissociate from impairments affecting recognition of identity from the face, and this observation has often been incorporated into models proposing separate functional routes for the processing of identity and expression. More recent work has demonstrated highly selective impairments affecting recognition of facial expressions of certain emotions—fear and anger after amygdala lesions, and disgust after insula or striatal damage. I will outline evidence suggesting that these emotion-specific impairments are not linked to abnormalities of facial expression recognition per se, but to abnormal recognition of these emotions across a range of forms of social signal (face, voice, posture, etc.). The idea that emotion recognition is more multimodal than identity recognition should be seriously entertained. Correspondence: *Reiner Sprengelmeyer, Ph.D., University of St. Andrews, School of Psychology, KY16 9AJ, St. Andrews, Great Britain. E-mail: rhs3@st-andrews.ac.uk*

**T. SUSLOW, T. DROSTE, C. ROESTEL, & V. AROLT. Automatic Processing of Facial Emotion in Schizophrenia With and Without Affective Negative Symptoms.**

It is assumed that people spontaneously evaluate any incoming stimulus as pleasant or unpleasant. The evaluative response appears to structure per-



ception and to have direct links to emotional states and overt behaviour. In this study we examined whether chronic schizophrenia patients suffering from affective negative symptoms manifest impairments in the automatic processing of face valence. A sequential priming task based on emotional face stimuli was administered to schizophrenia patients with a flat affect expression, schizophrenia patients suffering from anhedonia, schizophrenia patients not suffering from anhedonia or flat affect, and a group of healthy controls. Subjects were asked to evaluate target faces as quickly and accurately as possible. Schizophrenia patients without affective negative symptoms exhibited reversed priming effects similar to that of healthy subjects. For these groups an interaction of prime valence and target valence was observed. In contrast, flat affect patients and anhedonic patients showed only a prime effect due to negative facial valence. In the flat affect patient group, negative prime faces facilitated the evaluation of target faces, whereas in the anhedonic patient group negative prime faces tended to inhibit the evaluation of subsequent target faces. The present findings support the idea that chronic schizophrenia patients extract automatically the valence of emotional facial expression but they also suggest important processing differences between schizophrenia patients as a function of affective symptoms. Presence of affective negative symptoms in schizophrenia appears to be related to automatic processing patterns focused on the detection of negative facial expression.

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#### Paper Session 1/3:00–4:30 p.m.

### NEUROPSYCHOLOGY OF LANGUAGE

#### **E.C. FERSTL, T. GUTHKE, M. RINCK, & D.Y. VON CRAMON. The Neuroanatomy of Text Comprehension: Situation Model Processes in Non-Aphasic Language Disorders.**

Brain damage often causes so-called non-aphasic language disorders, in which communication skills are impaired despite the absence of noticeable aphasic symptoms. To study these deficits, text comprehension processes beyond the word and sentence level have to be evaluated. One component process is the building of a so-called situation model, i.e., a mental model of the global content of the text. This representation is an integration of the text information with the comprehender's prior knowledge. Behavioral studies have shown that for narrative texts, the situation model contains information on aspects such as the where, when and why of the story. In the present study, we used an inconsistency paradigm for evaluating situation model building after brain damage. The patients were selected for participation according to their lesion location, with a particular focus on prefrontal and temporal lesions. 16 short stories were read to the participants. Half of the stories contained inconsistencies with respect to the temporal or emotional aspects of the situation model. The patients' task was to indicate any inconsistencies they might have detected in the story. In a second step, the patients could use the printed version of the stories. A brain damaged control group showed almost perfect performance. In contrast, left-sided prefrontal lesions led to considerable difficulties with the inconsistency detection, independent of concurrent memory deficits. The results are discussed with respect to neuropsychological theories of text comprehension, then the paradigm's utility for the clinical diagnosis of non-aphasic language disorders is evaluated.

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#### **L. BARTHA, M. DELAZER, E. TRINKA, C. BRENNEIS, M. SCHOCKE, T. TRIEB, G. BAUER, & T. BENKE. Language Lateralization and Localization Patterns in Familial and Non-Familial Left-Handedness.**

Little is understood about the relation between handedness and language localization in human. As possible reasons for left-handedness, some re-

searchers stress environmental and biological factors, whereas others hypothesize genetic factors. However, these different explanations of left-handedness do not exclude each other; in fact, it may be hypothesized that left-handers do not constitute a homogeneous group. One possible criterion to differentiate subgroups is the familiarity of left-handers, but little evidence is available whether familial left-handers (LH+) and left-handers without family history of left-handedness (LH-) show different patterns of language localization. Thus, the present study aims to further explore the relationship between left-handedness and language lateralization and localization. We therefore used a well-known fMRI paradigm established by Binder et al. (1995) in 34 left-handed normals, 18 of whom had a familial history of left-handedness. We analyzed areas involved in language processing in each group, and we performed comparisons between the LH+ and LH- groups to find possible differences of lateralization and localization of language areas. Between-group comparisons revealed significant differences in language lateralization and localization. Whereas the LH+ subjects revealed a distributed, balanced bihemispheric, bitemporal network of language-related areas, activations in the LH- group were much stronger right lateralized, with the right frontal and temporal region displaying the most prominent activations. Our results evidence a strong linkage between familial sinistrality and neural language organization. The atypical language lateralization and localization patterns found in non-familial left-handers may hypothetically be explained by reorganization of language areas due to cortical changes in left temporal areas.

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#### **F. BURCHERT & R. DE BLESER. Morphology and Agrammatic Sentence Comprehension: Evidence From German.**

Broca's aphasia—a special form of acquired language disorder—is characterized by a non-fluent speech production. Furthermore, it has been shown that the production disorder is often accompanied by impaired sentence comprehension. One of the most influential theories on agrammatic comprehension is the Trace Deletion Hypothesis (TDH, Grodzinsky, 1990, 1995) which is formulated in the spirit of Generative Linguistics. The often found relative normal comprehension on sentences with basic word order (canonical sentences) and chance performance on sentences in which the word order has undergone changes (non-canonical sentences) is attributed to deleted traces of moved phrasal constituents. A central research question of our study was whether the strong cross-linguistic predictions that the TDH makes can be confirmed by data collected in a language with richer morphology than English. The generalisability of the TDH-pattern to morphologically rich languages is not obvious, given that case morphology can provide explicit cues that might beneficially influence sentence comprehension. We will provide a short overview of linguistic approaches to aphasia and present data from a study that investigated the syntactic comprehension of seven German speaking agrammatics. Our results indicate that morphology does not make a difference. However, our data do not generally confirm the TDH predictions for the group of agrammatic subjects. Single case analysis reveals different patterns of syntactic comprehension in agrammatic patients, a spectrum that encompasses near-normal comprehension of canonical and non-canonical sentences, overall chance performance, and TDH-like profiles. Obviously, different theoretical explanations are required to account for these different comprehension patterns.

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#### **L.-M. CHEN & W. HARTJE. Laterality Measures Based on Visual Half-Field Performance and on Changes of Cerebral Blood Flow Velocity as Indicators of Hemispheric Language Dominance.**

A right visual field (RVF) advantage due to faster reaction to or higher response accuracy for RVF stimuli is a robust finding of visual field studies using tasks of lexical decision. It is generally interpreted as an indica-

tor of left hemisphere language dominance. In this paradigm the index of functional laterality is derived from the performance level in the processing of right respectively left visual field stimuli, a different approach to the assessment of hemispheric language dominance is based on the measurement of changes of cerebral blood flow velocity during language activity. Recently, left hemisphere language dominance has reliably been demonstrated with functional transcranial ultrasound Doppler sonography (fTCD) during mental word generation and tasks requiring semantic language processing. In the study reported here fTCD measurement was performed while subjects (58 university students) were engaged in a lexical decision task with bilateral visual field presentation of abstract nouns. As expected, a highly significant RVF advantage was observed in this typical language task, indicating the particular involvement of the language dominant left hemisphere. In contrast, the fTCD index of laterality pointed to a higher activation of the right hemisphere. These findings reveal a disparity between the laterality indices based on visual field performance and on fTCD measurement. This cautions against the seemingly plausible assumption that physiological (activation) and psychological (performance) measures of functional asymmetry can be considered as equivalent indicators of hemispheric dominance.

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#### **E. ECKHOLT & N. STADIE. Evaluating Lexical and Nonlexical Based Reading Treatment in a Deep Dyslexic.**

Deep dyslexia is an acquired reading disorder in which both the nonlexical and the semantic-lexical routes are impaired (Morton & Patterson, 1980). Treatment studies with deep dyslexics have focussed on retraining the impaired grapheme-phoneme-correspondences (e.g., de Partz, 1986) but hardly any program has focussed on reactivating residual functions of the semantic-lexical routes. This study aimed at improving reading skills of a 31 year old deep dyslexic woman. Two methods were applied focussing either on treating lexical or nonlexical processing. For the lexical method we used a priming paradigm with semantically related primes for targets content words (e.g., Löwe (lion)—Tiger (tiger)) and phonologically similar primes for target function words (e.g., Nacht (night)—nach (after)). In the nonlexical method we trained grapheme-phoneme-associations and blending skills. Targets were controlled for word length, frequency, familiarity and animacy. For the evaluation of treatment outcomes a cross-over design with multiple baselines was used. We hypothesized that the lexical method leads to a greater treatment effect than the nonlexical method, since the former can rely on partially functioning mechanisms whereas the latter has to be fully re-learned (e.g., Berndt et al., 1994). However, we predicted significantly more maintenance effects from the nonlexical treatment, since this strategy can also be generalized to new items. Furthermore we hypothesized word-class specific performance patterns. Thus, we assumed that content words would profit more from the lexical method than function words, while no such difference should be found for non-lexically treated items. Results will be presented and discussed regarding the hypotheses.

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#### **S.J. CRUTCH & E.K. WARRINGTON. The Human Brain Map: Knowledge of City and Country Names Depends Upon Their Geographical Proximity.**

We report a patient, XYZ, whose semantic access disorder was harnessed to examine the cerebral organisation of proper noun concepts. In a series of experiments, we tested for the presence of semantic distance effects in a range of categories of knowledge within the broad class of place names. Using a spoken word-written word matching paradigm and arrays of four names, XYZ was able to identify target countries significantly more accurately from among unrelated (distant) than related (close) country names. Similar semantic distance effects were also observed for international cities and United Kingdom cities. Most unexpectedly, when only English

cities were included and semantic groupings were formed purely on the basis of geographical proximity (i.e., cities from the north, south, east and west), nonetheless XYZ's performance was significantly worse when the city names were arranged in geographically close than distant arrays (Close = 41/64, Distant = 53/64,  $\div 2 = 4.85$ ,  $P < .05$ ,  $df = 1$ ). By contrast, XYZ showed no sensitivity to the real-world geographical proximity of American states, with which she was less familiar. This novel pattern of performance provides the first detailed evidence of more fine-grain organisation within the proper noun fields described. The quality of the semantic relatedness effects observed suggest that in the development and specification of some country and city concepts, actual geographical location and proximity are important organisational principles. The influence of geographical information suggests that knowledge in this domain of conceptual knowledge is mediated by a spatial code.

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### **Paper Session 2/3:00–4:30 p.m.**

#### **NEUROPSYCHOLOGY OF ATTENTION**

#### **M. BÜHNER & L. SCHMIDT-ATZERT. Structure of the TAP in Elderly People.**

The test battery for attentional performance (TAP) (Zimmermann & Fimm, 1993) is a widely used instrument to assess attention deficits. Up to now, we know nothing about the structure of the subtests in samples with older participants. Only few investigations with brain damaged patients examined the structure of the TAP. Therefore one important question is whether the structure of the TAP can be confirmed in a sample of elderly participants. In the present investigation 142 healthy subjects with an age between 56 and 92 years participated. The aim of the study was to explore the structure of TAP test alertness, divided attention, go/no go, shift, visual scanning and working memory. The test scores (reaction time [Md, SD], omissions and false alarms) were transformed into Bloom-normal scores. An exploratory principal component analysis with oblique promax rotation and the lower bound eigenvalue greater one rule was conducted. The factors, which emerged could be extensively interpreted according to their test names. The results were discussed in the light of previous studies, which examined the structure of the TAP with brain damaged patients. Correspondence: *Markus Bühner, Ph.D., Philipps-Universität Marburg, Psychologie, Gutenbergstrasse 18, 35032 Marburg, Germany. E-mail: buehner@mail.uni-marburg.de*

#### **K. FINKE, P. BUBLAK, & W.X. SCHNEIDER. A New Diagnostic Tool for Measuring Attentional Components: Steps to Clinical Practise.**

Recent progress in neuroscience strongly suggests that attention consists of separable components supported by overlapping but independent cerebral networks. As a result, the neuropsychological assessment of attention disorders is increasingly faced with the problem to extract information about specific attentional components from tasks in which several components are confounded. We present a new method based on the theory of visual attention (TVA, Bundesen, 1990, 1998) that provides a useful tool for solving this problem. TVA is conceptualized as a mathematical model suggesting four independent parameters that represent separate components of visual attention: processing speed, working memory storage capacity, spatial distribution of attention, and top-down control. These parameters are derived from a subject's performance in whole and partial report of visual letter displays. To examine the applicability of this method as a clinical test we studied healthy subjects and patients suffering from brain dysfunction. A long version of whole and partial report experiments were applied to young subjects to obtain parameter estimates for each of the four attentional components. Furthermore, the reliability of those estimates was assessed for a trial number that is practical within a clinical setting. Additionally, by applying standard neuropsychological tests for the assessment of each attentional component, convergent and discrimi-

nant validity measures were obtained for the parameter estimates. Our results suggest that the TVA-based approach allows reliable and valid assessment of separable mechanisms of visual attention. Single case analyses in brain-damaged subjects also favor the assumption that—compared to standard clinical tests—the TVA-based approach improves the possibility to disentangle impaired and intact attentional components.

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#### **R. PTAK & A. SCHNIDER. Interaction Between Space-Based and Object-Based Components of Attention in Spatial Neglect.**

Whereas the contribution of space-based mechanisms to the manifestation of spatial neglect is well known, it is controversial to what extent neglect depends on object-based coordinates. We used a paradigm modeled on the peripheral cueing task by Posner to examine differential influences of space-based and object-based attention on target detection. A cue (red or green circle/square) was briefly presented to the left or right of fixation, followed by one ipsilesional and one contralesional colored form. The task was to decide whether one of the two forms presented after the cue was a red circle. Cue-target similarity and position were systematically varied. Thus, the cue could be coherent or incoherent with the target with respect to its position (spatial dimension) and with respect to its physical characteristics (object dimension). The performance of healthy participants was mainly characterised by slowed reactions when the cue was incoherent on the object dimension but presented on the same side as the target. This effect was equivalent for left and right targets, probably reflecting retinal mechanisms of sensory suppression. The performance of neglect patients was radically different, as they showed significant slowing when an on-tralesional target was preceded by an ipsilesional cue identical with the target on the object dimension. Thus, their attention was only captured by an ipsilesional cue when it was identical with the target. These results suggest that object-based attention is a strong determinant of the neglect syndrome and that damage to the temporal-parietal cortex leads to exaggerated engagement of attention on objects.

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#### **R. VERLEGER & P. JASKOWSKI. Lack of Visual Awareness With Masked Stimuli and in Pathological Neglect: Towards an Integrated Model.**

Both in masking by metacontrast and in pathological extinction, as part of the hemineglect syndrome, stimuli are unidentifiable by another stimulus that occurs in close temporal proximity. So far, both phenomena have been considered separately. Our data (response times, eye movements, EEG potentials) enable us to ask for common mechanisms. Extinction, as commonly found in neglect patients, is lack of awareness of some stimulus on the affected side in the presence of another stimulus on the unaffected side. With this critical combination of stimuli, these patients lack an early negative peak in their EEG potentials. This can be interpreted as a deficit in attention, more precisely as a deficit in focused attention as shown by our data on the dependence of patients' response times on eye movements. Masking by metacontrast makes stimuli unidentifiable for healthy subjects, by presenting stimuli in close temporal succession at different locations. Yet these unidentified stimuli may prime responses and, as reflected by a posterior-parietal EEG component, may prime shifts of visual attention. Therefore, mechanisms possibly common to extinction and masking should refer to shifting attention and to integrating simultaneously perceived conflicting information. A candidate mechanism to account for both phenomena is that both the masking and the extinguishing stimuli prevent "re-entrant processing" of the masked and extinguished stimuli. This concept has been developed in the metacontrast literature and might be fruitfully applied to explain the pathological phenomena of extinction and neglect.

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#### **T. GUTHKE, A. SANDMANN, & E.C. FERSTL. Auditory Distractability After Brain Injury: Is it an Attentional or a Text Comprehension Deficit?**

Brain damaged patients often complain about auditory distractability. They frequently report that they have difficulties following conversations in group settings or in a noisy environment. This deficit could be due either to problems with allocation of attention in the presence of multiple stimuli, or to problems with verbal interference when multiple language input needs to be processed in parallel. In order to distinguish these processes we developed a paradigm for assessing distractability by verbal and non-verbal background noise in the context of naturally occurring connected text. Analogous to previously used text material (Walther et al., 2000) we wrote nine stories with eight associated yes/no questions each. The stories were presented auditorily with underlying noise. The verbal distractor consisted of party noise, including spoken conversations, the non-verbal distractor was traffic noise, and the control condition consisted of uniform pink noise. We tested younger and older control subjects, and three groups of brain damaged patients (attentional deficit, aphasia, and non-aphasic communication disorder). Whereas the control subjects showed good text comprehension performances and no influence of distractor type, the performance of the brain damaged patients were dramatically influenced by the distractor and the influence of the distractor type was dependent on the functional deficit of the patients. Our paradigm can help to develop a diagnostic instrument for disentangling attentional from text and language comprehension problems. An important conclusion is that clinical diagnosis of text comprehension difficulties must include naturalistic conditions, including background noise, and cannot be restricted to tests conducted in laboratory settings.

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**Symposium 3/5:00–6:30 p.m.**

#### **LANGUAGE PROCESSING IN THE BRAIN: CURRENT TRENDS IN FUNCTIONAL NEUROIMAGING RESEARCH**

**Organizers: Christian J. Fiebach and Arthur M. Jacobs**  
**Chair: Christian J. Fiebach**

#### **C.J. FIEBACH. Language Processing in the Brain: Current Trends in Functional Neuroimaging Research.**

The study of language processing was one of the first areas of research in which modern functional imaging techniques such as Positron Emission Tomography (PET) and functional magnetic resonance imaging (fMRI) were employed to investigate cognitive processes. Despite this relatively long tradition, the last few years have brought a renewed interest in more fine-grained studies of the visual and auditory word recognition systems, as well as in higher level cognitive systems involved in sentence and text comprehension. In particular, more sensitive research methods have been combined with experimental designs isolating specific aspects of language processing, allowing to go well beyond the insights from the first imaging studies on language. In the present symposium, a selection of active researchers from the field of neurocognition of language will introduce their work using functional neuroimaging (i.e., PET and/or fMRI) to investigate different aspects of language processing. Three contributions will focus on the perceptual and lexical-semantic aspects of word recognition. Davis investigates the processing of different word categories and how word recognition is modulated by repetition. The other two contributions on word processing investigate how neural activity is modulated by lexical variables such as word frequency (Hutzler, Fiebach) and age of word acquisition (Fiebach). The two following talks have as their topic higher-level aspects of language processing. Perani investigates syntactic processing at the sentence level. Using special PET techniques, the involved transmitter systems are mapped and the relation to pathological states in



neurological patients is discussed. Finally, Scott integrates evidence from PET studies with Transcranial Magnetic Stimulation (TMS) and eye tracking in alexic patients in order to investigate how the brain plans and executes saccadic eye movements during text reading. The five contributions to this symposium demonstrate how functional neuroimaging techniques can be utilized in the investigation of language at different levels of representation. The integration of the different approaches, methods, and paradigms represented here will be important for achieving a more complete understanding of how the brain processes language.

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**M. DAVIS. The Neural Basis for Visual Word Recognition: Evidence from Functional MRI.**

Cognitive models of visual word recognition postulate a direct “lexical/semantic” route involved in accessing the meaning of words. However, the neural basis of this processing systems remains unclear. In this presentation we present evidence from functional magnetic resonance imaging to support the localisation of early stages of lexical and semantic processing in posterior temporal lobe regions. A blocked-design functional MRI study compared activation in response to real words (a mixture of nouns and verbs presented for a one-back semantic monitoring task) with responses to matched letter strings (letter monitoring). Activation differences between words and letter strings were observed in regions anterior to the fusiform word-form area identified by Cohen et al. (2002), while a more lateral temporal region showed elevated activation for verbs compared to nouns suggesting that this region does not only represent the visual form of words, but also encodes semantic/syntactic properties. Further evidence comes from an event-related fMRI study in which words and pseudo-words were presented for lexical decision. A contrast with a rest baseline (null-events) showed activation in a stream of visual areas running from inferior occipital regions along the fusiform gyrus. Comparisons between word and pseudo-words highlighted a more medial fusiform region, which showed elevated activation for words. However, this effect of lexical status was modulated by repetition, with no difference between words and pseudo-words on repeated presentation. Elevated responses to real words in the fusiform may not reflect differences between items with and without stored lexical/semantic representations but modulation of earlier visual processes.

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**F. HUTZLER, M. KRONBICHLER, A. MAIR, W. STAFFEN, G. LADURNER, & H. WIMMER. Two Routes, Two Statistical Approaches: Categorical and Parametric Effects in the Reading Brain.**

From the perspective of dual route models, one would expect discrete differences in brain activation for both high- and low-frequency words indicating the involvement of at least partially distinct anatomical reading pathways. In contrast the single-pathway models suggest the involvement of the same brain areas for both types words—but to a varying degree, depending on word familiarity. To our knowledge, recent neuroimaging studies of reading solely used categorical designs (i.e., contrasting directly different types of words), but no parametric designs. However, only parametric designs make it possible to characterize the relationship between an experimental parameter and the elicited BOLD response. In the present study, a parametric design was used to investigate the claims of single and dual-pathway models. A block design was used to collect fMRI data from 13 adults during the silent reading of words and pseudowords. For real words, four levels of word frequency were realized. One relevant finding in the pseudoword *versus* word reading contrast was that a categorical analysis revealed stronger activation in left inferior temporal and left prefrontal regions and the left IFG. In a subsequent parametrical analysis both the left prefrontal region and the left IFG showed a linear effect, i.e., activity increased with decreasing item frequency. No such effect was

found for the left inferior temporal region. This linear increase of activity in the IFG could indicate, that grapheme to phoneme conversion is involved during the reading of non-lexical and lexical material—as proposed by single pathway models.

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**C.J. FIEBACH, A.E. HERNANDEZ, & A.D. FRIEDERICI. Neural Correlates of Word Frequency and Age of Word Acquisition in Word Processing.**

The frequency of a word's occurrence determines the efficiency of certain aspects of word processing, and it has been demonstrated that frequency also affects the recruitment of left inferior frontal brain areas during lexical access. In the behavioral word recognition literature, however, it is currently debated whether the age of word acquisition (in the mother tongue) or word frequency is the more important determinant of word processing performance. We report two event-related fMRI studies of visual and auditory word processing in which participants made lexical decisions. Using a multiple regression approach with word frequency and estimated age of word acquisition as separate predictors, we isolated the unique variance components in brain activation produced by each factor. Word acquisition age modulated a more widespread network of brain regions than word frequency. This network was not overlapping with areas influenced by frequency. In both modalities, processing earlier learned words was associated with greater activity in the medial parietal lobe (precuneus) whereas late learned words induced greater activity in anterior inferior frontal and posterior orbitofrontal cortex. In the visual domain, early learned words in addition showed activation of the left temporo-occipital region, encompassing the gyrus of Heschl. We conclude that word processing in adults is influenced by the way words were learned earlier in life. Processing late acquired words involves a recruitment of frontal areas commonly associated with effortful or strategic retrieval of semantic knowledge. Processing early learned words activates sensory representations in the domain in which these words were learned (auditory-phonological).

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**D. PERANI, M. TETTAMANTI, A. MORO, & S.F. CAPPÀ. PET Studies in Word/Sentence Processing.**

Neuroimaging studies have shown *in vivo* the neural substrates for language processes. The choice of tasks and paradigms is crucial in disentangling selective cognitive processes. PET is also unique for the possibility of investigating the neurotransmission systems. Many paradigms employed so far with functional imaging in language studies do not allow a clear differentiation of the semantic, morphological and syntactic components, as traditionally defined within linguistic theory. We isolated the functional correlates of morphological and syntactic processing by neutralizing the lexical-semantic component using sentences consisting of pseudo-words. In both syntactic and morphosyntactic processing, the activation of a selective deep component of Broca's area and of a right inferior frontal region was detected by H215O PET. In addition, within this system, the left caudate nucleus and insula were activated only during syntactic processing. This is an *in vivo* evidence of the contribution of an integrated cortical-subcortical neural network selectively engaged in syntactic computation. In accordance with the present data and with clinical evidence, we assessed levels of striatal dopamine release *in vivo* with PET using the brain uptake of the dopamine D2 receptor ligand, [<sup>11</sup>C]raclopride. Competition between endogenous dopamine and [<sup>11</sup>C]raclopride is the principle underlying this approach. We used the same paradigm described for the above PET activation study to examine the role of dopamine in sentences processing. Our results support the existence of a left hemispheric dopaminergic activity in humans, which was more extensive



for syntactic processing, and suggest that grammatical deficits might be also related to a dysfunctional dopaminergic system.

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#### **S.K. SCOTT, A. LEFF, T. HODGSON, & R.J.S. WISE. The Neural Systems Involved in Text Reading: PET, TMS, and Patient Studies.**

When skilled readers read text, their eyes move across the words in fixations and saccades. Each fixation (when the eyes are still) lasts around 200ms, most of which time is spent planning the next saccade (since word recognition takes around 50ms). It has been demonstrated that this planning (in left to right readers) involves a rightwardly directed window of attention, which uses low spatial frequency word shape information to plan which word to fixate upon next. We have shown in Positron Emission Tomography (PET) studies that the neural systems involved in the movement of the eyes, separate from the system involved in recognising the text, includes the posterior parietal cortex (left > right) and frontal eye fields (right > left) (involved in eye movements) and a left parafoveal region in primary visual cortex, which reflects the use of rightwards visual word shape information used to plan the next saccade. Transcranial Magnetic Stimulation (TMS) of the parietal and frontal eye field regions reveals that they have differential involvement in eye movements in terms of timing. TMS of the left parietal cortex slowed saccades across a text array, but TMS of the right frontal eye field slowed the initial saccade only. PET studies and eye movement studies of patients with hemianopic alexia show the role of right parafoveal space in left to right reading, and also how this can be modified by rehabilitation.

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**Symposium 4/5:00–6:30 p.m.**

### **VISION TRAINING AFTER BRAIN DAMAGE**

**Chair: Bernhard A. Sabel**

**Organizer: Iris Müller**

#### **I. MÜLLER & B.A. SABEL. Vision Training After Brain Damage.**

The visual system occupies a great amount of the cerebral cortex, therefore brain injuries or strokes often result in visual deficits. These deficits have long been considered as non-treatable, but this view is changing now. The functions of the visual system have been explored with increasing detail within the last decades. Several observations contribute to our understanding of the brain's plasticity to respond to injury in an adaptive way. This includes the facts that humans recover some of their lost visual functions spontaneously and, in addition training can be used effectively to improve vision following damage. The symposium presents a wide spectrum of talks on plasticity of the visual system. This includes the importance of a detailed diagnosis of residual capacities with specific computer based procedures. Experimental studies about training of residual vision in adults showing blindsight, patients suffering from visual field defects and cerebral blind children will be presented. Possible predictive factors for successful visual therapy using a retrospective analysis of clinical data will be discussed. To understand the underlying mechanism of residual vision, an overview of neurobiological visual system repair will be given.

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#### **E. KASTEN, I. MÜLLER, & B.A. SABEL. Improvement of Visual Functions in Patients With Visual Field Defects.**

*Purpose:* Partial blindness after brain injury has been considered nontreatable for many years. In several placebo-controlled clinical trials we showed

that a computer-based visual training increases the size of the intact visual field. *Methods:* Patients with homonymous visual field defects were investigated before and after training. For evaluation the automated static high resolution campimetry was used. All patients had stable homonymous defects due to trauma, cerebral ischemia or hemorrhage (lesion age >1 yr). The patients carried out the visual restitution training on their computer at home daily for one hour over a period of six months. Training parameters were regularly adjusted to the individual pattern of residual vision for each patient. *Results:* Many patients showed an improvement of visual field size after the training procedure. At follow-up most patients showed only a minor loss of visual functions which they had regained due to the restitution training. An improvement of color and shape recognition due to the pure detection training was found in some groups of patients, but in others not. *Conclusion:* Areas of residual vision in the border of the blind part of the visual field can be stimulated and extended with a specific visual restitution training in many patients suffering from brain damage. Correspondence: *Erich Kasten, Ph.D., Otto-von Guericke-University Magdeburg, Institute of Medical Psychology, Leipziger Strasse 44, 39120 Magdeburg, Germany. E-mail: erikasten@aol.com*

#### **I. MÜLLER, E. KASTEN, B.A. SABEL. Identifying Training Potential in Patients With Visual Field Defects.**

Computer based visual restitution therapy (VRT) is a home training procedure which has been shown to be effective in patients with visual field deficits in several experimental studies (e.g., Kasten et al., *Nature med.*, 1998). However, there is a high degree of interindividual variability in the amount of intact visual field size that can be regained using VRT. In order to identify predictors of training outcome, a retrospective analysis of clinical data of 73 patients with post-chiasmatic or optic nerve injuries has been performed. Patients showed an average enlargement of about 10% intact visual field in monocular and binocular perimetric testing. About 2/3 of the patients reported subjective improvement in more than one category of daily life activities. On the basis of experience with previous studies, several variables were selected as potential candidates predicting the outcome of VRT. Increased response times at baseline in High Resolution Perimetry were significantly correlated with recovery of vision (Pearson's  $r = .44$ ) and might indicate a possible plasticity potential in patients using VRT. Patients with longer reaction times in the visual field test experienced a more pronounced increase of intact visual field than patients with faster reaction to supra-threshold stimulation. Additionally, pre-post response time improvements in computer perimetry was significantly correlated with training success. Results may be explained in terms of perceptual as well as cognitive factors, but however highlight the importance of time processing of visual information for training of vision.

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#### **L. JULKUNEN, O. TENOVUO, S. JÄÄSKELÄINEN, & H. HÄMÄ-LÄINEN. Rehabilitation of Chronic Visual Field Defect With Computer-Assisted Training.**

*Purpose:* Our aim was to study whether homonymous visual field defects could be restored in chronic stroke patients ( $N = 5$ ) using computer-assisted training, and whether the possible beneficial effect could be maintained. Visual evoked potential (VEP) recordings were applied to evaluate whether they could demonstrate the possible training effects at the cortical level. *Methods:* We applied a specially designed computer program in the training. A training period of three months was succeeded by a three-month follow-up without training. Subjective assessment, static and kinetic perimetry, and pattern reversal hemifield VEP recordings were used to detect the possible changes, the static perimetry being the basis of the evaluation of the changes in the visual field. *Results:* Two patients showed improvements in the trained area immediately after the training in the static perimetry. Further improvements were detected at the later follow-up in three patients. In the kinetic perimetry, improvements were detected in three patients. The visual field defect could be verified with the VEP recordings in four patients before the training, and improvements were

detected in three patients, two of which clearly improved in the static perimetry as well. The subjective evaluations were in accordance with the objective results only in two patients. **Conclusions:** The visual field defect diminished in three patients in the static perimetry after computer-assisted training. Two of these patients gained subjective benefit. No general conclusions on the recovery of visual field defects in stroke patients could be drawn, but probable training-related improvements in chronic stroke patients were shown.

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### P. STÖRIG. Learning Blindsight.

Blindsight, the non-reflexive residual visual functions elicited from fields of absolute cortical blindness although the patients are unaware of the stimuli they respond to, is commonly regarded as a rare phenomenon. This impression is based both on many single-subject studies and on the often low numbers of patients displaying positive results in multi-subject reports. While there can be no doubt that in addition to the size and position of the lesion, the task tested has a major influence on whether positive results are obtained, the effect of training has not been assessed. To learn whether performance improves over time when on-line feedback is given, four patients with unilateral fields of cortical blindness were tested on four 2AFC-tasks. 5°, 300ms targets were presented in the blind field in series measuring detection, discrimination of blue and red, of horizontal and vertical orientation, and of coloured images of natural objects. In all four tasks, a probability of 1:4 was used to increase the salience of the rare event, and eye-movements were monitored. The patients responded by pressing one of two buttons to indicate what stimulus had just appeared. Results show that while only the patient with the smallest lesion required almost no training, all four sooner or later discriminated orientation and blue/red; object image discrimination was most difficult. They demonstrate that blindsight is not an all-or-nothing phenomenon easily revealed with limited testing, and open new perspectives for functional improvement. Correspondence: *Petra Störig, Ph.D., Institute of Experimental Psychology II, Bldg. 23.03, Universitätsstrasse 1, 40225 Düsseldorf, Germany. E-mail: petra.stoerig@uni-duesseldorf.de*

### R. WERTH. Recovery of Visual Functions in Cerebrally Blind Children.

We show that the visual field of children who did not recover spontaneously from cerebral blindness within one year may expand up to 90° eccentricity within three months when a systematic visual field training is applied. Sixteen children aged 1 to 4 years who were blind for more than one year after perinatal asphyxia participated in a systematic visual field training. The functional visual field was assessed with a specially designed arc perimeter. Visual functions developed within a training period of three months in 11 children who received visual field training whereas there was no recovery in the control-group ( $N = 26$ ). It was further shown that brain tissue in the damaged area of the occipital lobe could only be activated by light in children who recovered from blindness using functional magnetic resonance imaging. In the children who did not recover, no activation of cerebral tissue was found. The findings support the assumption that a systematic visual field training facilitates the development of vision in cerebrally blind children. This development appears to be mediated by surviving neurons in the occipital lobe.

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### B.A. SABEL. Neurobiological Mechanisms of Visual Training.

Visual restitution training (VRT) improves visual functions in stroke and head injury patients (see [www.novavision.info](http://www.novavision.info)). This effect was demonstrated in several, independent laboratories (see Kasten et al., *Nature med.* 4, 1998, p. 1083) which employed subjective measures, quantitative perimetry and reaction time analyses. Several observations shed light on the mechanism of the training effect. (a) Subjective improvements due to VRT are observed in 70% of the patients with visual field defects, yet not all

patients show visual field enlargements as indicated by shifts of the border of the absolute defects. (b) Visual field enlargements are small if one considers absolute defects, but they are larger if relative defects—also called “areas of residual vision”—are considered. (c) Some patients also show visual field enlargements, yet no subjective improvements. This partial dissociation between subjective and quantitative improvements due to visual training indicates that factors other than border shifts account for restitution of vision. We have therefore analysed in greater detail the function of areas of residual vision and of the intact part of the visual field. We found improvements of reaction time in presumably “intact” regions of the visual field. This suggests that the so-called “intact” visual field sector may, in fact, be functionally impaired and that, in addition to improving areas of residual vision, visual training improves visual functions of the intact regions as well. I therefore propose that training-induced improvements involve two cell populations: surviving cells in areas of residual vision and neurons in “intact” regions which were subject to interhemispheric deafferentation.

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## Paper Session 3/5:00–6:30 p.m.

### NEUROPSYCHIATRY

#### V.P. BOZIKAS, M.H. KOSMIDIS, & A. KARAVATOS. Relationship Between Psychopathology and Cognitive Functioning in Schizophrenia.

**Background:** The purpose of this study was to delineate the relationships between positive, negative, cognitive, depressive, and excitement symptom dimensions of schizophrenia and cognitive functioning. **Method:** Fifty-eight patients with schizophrenia were assessed using PANSS ratings and a battery of neuropsychological tests (executive function/abstraction, verbal and spatial working memory, verbal and non-verbal memory/learning, attention, visuospatial ability, and psychomotor speed). **Results:** As expected the cognitive symptom dimension correlated with the majority of the neuropsychological tests administered. Severity of the negative symptom dimension was related to impairment in the structure of the semantic knowledge system and information processing problems, inefficient response inhibition, verbal working memory, verbal memory (immediate and delayed recall, and recognition), auditory attention, and psychomotor speed. In contrast, severity of the positive symptom dimension correlated only with impairment in the structure of the semantic knowledge system, visual attention, and psychomotor speed. Finally, severity of the depressive symptom dimension was associated only with verbal and visual working memory, as well as with visual recognition. Correlations between symptom dimensions and cognitive measures were at best modest. **Conclusion:** Despite the fact that symptom dimensions correlated with different types of cognitive performance in a group of patients with schizophrenia, these correlations were at best modest suggesting that psychopathology and cognitive deficits in schizophrenia are related but distinct constructs. Correspondence: *Vasilis P. Bozikas, Ph.D., Department of Psychiatry, Aristotle University of Thessaloniki, 54124 Thessaloniki, Greece. E-mail: vpbzikas@oneway.gr*

#### R. CARLSSON, H. NYMAN, G. GANSE, & J. CULLBERG. First-Episode Psychosis. Neuropsychological Functioning and Outcome at 3-Year Follow-Up.

In the Parachute project 121 patients with first episode psychosis were examined by the neuropsychological version of Wechsler's Adult Intelligence Scale (WAIS-R NI) within two months after admission. The results were compared to those of 30 healthy volunteers, matched in age, educational level and gender distribution. Patients were found to perform significantly lower in all subtests, except Information. Patients with a diagnosis of schizophrenia performed worse than other subgroups. Those who had performed low at the initial WAIS-R NI examination had a less favourable outcome regarding positive as well as negative symptoms and overall

functional level at 1 year and 3 year. 97 patients were reassessed by WAIS-R NI 3 years after admission and the results show no significant changes from baseline but a slight improvement for almost all patients in the verbal subtests. On performance subtests there were almost no changes. The results of the initial neuropsychological examination had significant predictive value regarding symptomatic and functional outcome. The re-examination at 3 years follow-up supports this finding. It is suggested that early initial and careful examination of neuropsychological deficits in psychosis is important for the choice of the effective therapeutic interventions and the test-profile is prognostic for functional and symptomatic outcome. Relationships with medication status at examination, differences between diagnostic groups and the effect of the duration of untreated psychosis will be discussed.

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**J. EGELAND, N.I. LANDRØ, K. SUNDET, A. ASBJØRNSSEN, K. HUGDAHL, A. LUND, A. RONESS, K.I. STORDAL, & B.R. RUND. Distinct Amnesic and Executive Memory Deficits in a Psychiatric Sample.**

Temporal brain lesions are known to cause an amnesic type of memory dysfunction characterized by impairments in both free recall and recognition memory, while frontal lobe lesions cause executive dysfunction characterized by retrieval deficit, i.e., a disproportionate impairment in free recall relative to recognition. Although patients with schizophrenia and depression do not display discrete brain lesions, it is possible that also they display variants of executive or amnesic memory failure. The study tests whether classifications of psychiatric patients into recall impaired (R) and Recall + Recognition impaired (R+R) groups correspond to the executive type and amnesic type of memory impairment. This expectation is named the "dissociation hypothesis". Contrary to this, the "continuity hypothesis" predicts that the R+R group is merely more neuropsychologically and psychiatrically impaired than the R-group. *Methods:* Forty-four subjects impaired on California Verbal Memory Test were selected from a larger database of 103 subjects with schizophrenia or major depression. Subjects were classified into R and R + R groups and compared on measures of memory strategy (CVLT-recency and interference), overall neuropsychological function (Stroop Test and WAIS-R similarity) and psychiatric symptom load (positive and negative symptoms). *Results:* Repeated measures ANOVA showed no group differences with regard to memory strategy, neuropsychological function or psychiatric symptom load. Thus the continuity hypothesis was not supported. The R-group showed more interference and negative symptoms than the R+R group, while they had more normal recency score and less positive symptoms. These interaction effects in two of the three analyses, gave partial support for the dissociation hypothesis.

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**M. GORISSEN, J.C. SANZ DE LA TORRE, & B. SCHMAND. Effort in the Neuropsychological Evaluation of Schizophrenia (ENES Study).**

Most if not all of the cognitive disorders that accompany schizophrenia concern failures of effortful information processing. This hypothesis was inferred about 20 years ago from the cognitive and psychophysiological research available at that time and it still is a prevailing one. Several studies have attempted to directly test the hypothesis. However, these studies suffered methodological problems. For example, the amount of effort invested by the patients was confounded by task difficulty. Furthermore, methods of measurement of effort lacked sufficient empirical validation or were of limited validity in the context of cognition. The objective of the present experiment is to determine whether, and if so, to what extent the cognitive disorders in schizophrenia patients are due to insufficient effort. Mental effort was measured with the Word Memory Test (WMT), which has been developed and empirically validated in malingering research. Schizophrenic patients ( $n = 37$ ), non-psychotic psychiatric patients ( $n = 40$ ), neurological controls ( $n = 20$ ), and normal controls ( $n =$

23) were tested with a neuropsychological test battery measuring predominantly memory and attention. The results show that schizophrenia patients score less than both control groups on the effort test. Moreover a significant amount of variance in the neuropsychological test scores of schizophrenic patients is explained by their scores on the effort test. This lends support to the notion that cognitive disorders in schizophrenia are due to insufficient effort. Implications of these results for cognitive research in schizophrenia will be discussed.

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**M.H. KOSMIDIS, V.P. BOZIKAS, M. GIANNAKOU, D. ANEZOU-LAKI, & A. KARAVATOS. Impaired Affect Recognition Without Visuo-perceptual Deficits in Schizophrenia.**

We examined the ability of patients with schizophrenia to perceive emotional expressions when given individual faces to match and when given social scenarios. In particular, we sought to assess the relative contribution of visuo-perceptual abilities in affect perception. We assessed 37 patients and 32 healthy controls, matched on age and education, with a series of computerized tests: matching the identity of faces, matching facial emotional expressions, discrimination of subtle differences in facial emotional intensity, and perception of appropriate emotions in social scenarios. When compared with the healthy group, patients with schizophrenia had difficulty matching facial expressions whether given individual photographs [ $t(65) = 3.673, p = .001$ ] or social scenarios [ $t(65) = 2.455, p = .017$ ], despite their intact performance on matching facial identity [ $t(65) = 1.399, p = .167$ ] and discriminating between subtle differences in emotional intensity [ $t(67) = .718, p = .475$ ]. Patient performance did not correlate with either positive or negative symptoms, as measured with the PANSS. In conclusion, our study demonstrated that patients with schizophrenia have deficits in perceiving emotions both in individual stimuli and in social scenarios. These deficits do not appear to exist on visuo-perceptual tasks that depend on identity matching and discrimination of the relative intensity of emotional facial expression. The deficit of patients with schizophrenia in perceiving emotional facial expressions may play a role in some of the interpersonal difficulties they experience. Future investigations should explore the relationship of these deficits in daily functioning.

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**B.A. MARCOPULOS, P. ESPE-PFEIFFER, & J.F. MANLEY. The Effect of Neurocognitive Risk Factors on CVLT Performance in Schizophrenia.**

Memory deficits associated with schizophrenia have been well documented (e.g., Paulsen et al., 1995). The effect of neurocognitive risk factors, such as low levels of education, low IQ, and learning disabilities on memory performance in this population, is less well understood, since most studies exclude these variables to focus exclusively on the effects of schizophrenia. However, clinicians working in a psychiatric setting frequently must evaluate patients who have multiple neurocognitive risk factors, in addition to their persistent mental illness, which must be taken into account when interpreting neuropsychological tests. This study evaluated the influence of education, IQ and WRAT Reading on California Verbal Learning Test performance. Participants were 118 adults with schizophrenia spectrum illness who were referred for neuropsychological evaluation while hospitalized at a state psychiatric facility. The average age was 36.14 (SD = 10.68) years and average education was 11.71 (SD = 2.25) years. Hierarchical multiple regressions were performed, entering Full Scale IQ first, then years of education, then WRAT Reading. Most subjects' memory performance fell in the moderately impaired range and FSIQ was the most important predictor for almost all the CVLT variables, with  $R^2$  ranging from .401 for total words recalled across 5 trials to .112



for False Positives on Recognition. After accounting for IQ, years of education and WRAT Reading did not provide additional variance, with the exception of Intrusion Errors, which were predicted by WRAT Reading ( $R^2 = .615$ ), but not by IQ or education. Clinical implications and directions for future research are discussed.

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#### Paper Session 4/5:00–6:30 p.m.

### PERCEPTION AND PERFORMANCE

#### **E. DIRKS, L. DE SONNEVILLE, G. SPYER, & E. VAN LIESHOUT. Sustained Auditory Discrimination: Age, Task Difficulty, and Learning Effects.**

We investigated sustained auditory attention performance of 19 younger ( $8.5 \pm .5$  years) and 21 older children ( $11.7 \pm .3$  years) on two task versions (easy and difficult). All children performed both versions, half started with the easy and half with the difficult version. The children had to discriminate between three tones that differed in pitch, with the target tone having the highest pitch. Pitch of the three tones in the easy version was 200, 450, and 700 Hz, and in the difficult version 400, 550, and 700 Hz. *Results:* since the groups are rather small, effect size (partial eta squared [ $\partial\eta^2$ ]) will also be reported. The younger children made more errors than the older children [ $F(1,37) = 19.87, p < .001, \partial\eta^2 = .35$ ]. Test order interacted with test version: the children made more errors on the difficult version than on the easy version, and this difference was largest when the difficult version was the second task [ $F(1,37) = 45.05, p < .0001, \partial\eta^2 = .55$ ]. Performance on the second task was better than on the first task and this improvement tended to be largest for the younger children [ $F(1,37) = 3.76, p = .06, \partial\eta^2 = .09$ ]. When administered as the first task, the younger children show no difference in performance on the easy and difficult versions, whereas the older children made less errors on the easy version than on the difficult version. When administered as the second task, both groups made less errors on the easy version than on the difficult one. The results will be discussed in relation to transfer and learning effects.

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#### **S.R. SCHWEINBERGER, V. HUDDY, E.C. PICKERING, A.M. BURTON, I. JENTZSCH, & J.M. KAUFMANN. Face-Specific Brain Potential Correlates of Repetition Priming in the Ventral Temporal Lobe.**

We investigated immediate repetition effects in face recognition by recording event-related brain potentials (ERPs). In Experiment 1, participants recognized faces that were preceded by either the same picture, a different picture of the same face, or a different face. Consistent with earlier reports (Schweinberger, Pfütze, & Sommer, 1995), face repetition elicited a strong modulation of an N250 component (around 200–350 ms) over inferior temporal regions. The N250 repetition effect (N250r) was also seen for repetitions across different pictures, but was reduced in amplitude. No repetition effects were seen for N170. Source localization (BESA) suggested that the N250r originated in fusiform cortex, whereas the N170 was generated in a more lateral occipitotemporal source. In Experiment 2, participants counted rare pictures of butterflies interspersed in a series of pairs of other visually homogeneous categories (human faces, ape faces, inverted faces, and car fronts). The second stimulus of each pair could either be a repetition or a nonrepetition of the first stimulus. Replicating earlier findings, N170 was larger and delayed for inverted faces. However, a clear N170 was seen for all categories. In contrast, face-specific N250r was seen over right inferior temporal areas: N250r was very large for human faces, smaller but still clear for ape faces, but absent for both inverted faces and cars. We conclude that N250r is a face-specific ERP

repetition effect which may indicate the transient activation of facial representations for recognition in ventral temporal brain areas.

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#### **B. STEPHAN, D. CAINE, & N. BREEN. Configuring Prosopagnosia: Part Versus Whole-Face Processing of Face Identity and Facial Expression.**

Prosopagnosia is currently viewed within the constraints of one of two competing theories of face recognition, one highlighting the analysis of features, the other focusing on configural processing of the whole face. This study investigated the role of feature analysis *versus* configural processing in recognition of identity from faces and recognition of facial expression. In a series of experiments a prosopagnosic patient, SC, was presented with face features for matching, and with faces (famous and personally familiar), face expressions and objects for identification. The results show that his early perceptual processing was completely intact, (e.g., individual facial features could be successfully matched in both face neutral and face expression conditions, even when matching across expression), but he was incapable of identifying previously known faces, whether famous or personally familiar. He could recognise some emotional expressions (e.g., happiness) but not others (e.g., sadness, anger, disgust). Analyses of these findings suggest that his deficit lies in whole-face configural processing and not in the processing of individual features. Examination of SC's visual scan path on viewing faces further substantiates this view. It is argued that underlying the structural encoding and recognition of facial stimuli are two separable parallel processing mechanisms; one that is dedicated to processing part-based information and the other dedicated to processing holistic information (generation of a gestalt). Integrity of the latter appears to be necessary for successful attribution of facial identity, and for the recognition of some but not all facial expressions.

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#### **J. BUTTET SOVILLA, L. BURGAT, R. CORREA HEIM, S. CLARKE, & F. GROSJEAN. Pure Verbal Apraxia With Phonetic On-Line Deficit: A Search for Explanations.**

Pure verbal apraxia is very rare. Most studies investigate output characteristics without detailed examination of auditory perception. Our patient, a 40 yr old right handed male, suffered from a sudden onset of mutism and right hemiplegia; the latter disappeared after 30 minutes. MRI showed two acute left hemispheric lesions: a large one on the inferior central sulcus and precentral gyri and a small one on the posterior superior temporal gyrus. Five days later, the patient was still mute, but could hum a short melody (without words). No speech output could be elicited in any situation: automatic speech, repetition, naming, etc. Auditory comprehension was flawless. Writing and written understanding were perfect. Bucco-facial and limb movements and drawing were good. The rest of the neuropsychological examination was normal, except for a mildly impaired verbal span. There were no difficulties on classical auditory off line tests, in particular when discriminating minimal phonetic pairs or identifying CV words with stop consonants. In contrast, the discrimination of close or distant phonetic pairs showed no significant difference in an on-line test. As all off line tests were normal, this result was unexpected and could not be explained by a simple lesion effect, since the on-line discrimination of pure tones showed no impairment. At least two hypotheses can be proposed to try to explain this interesting result: one is theoretical and is derived from the old motor theory of speech perception and the other one is anatomical and relies on the auditory-motor interface system used for explicit tasks.

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## Thursday Morning, July 17, 2003

### Poster Session 1/9:00 a.m.–12:30 p.m.

#### APHASIA AND LANGUAGE

##### **M. BRÜGMANN, C. KARLOWSKY, B.O. HÜTTER, & J.M. GILSBACH. Aphasia Following Subarachnoid Hemorrhage. The Impact on Health Related Quality of Life.**

**Background:** The long-term impact of acute aphasic disturbances after subarachnoid hemorrhage (SAH) on "Health Related Quality of Life" (HRQoL) was examined. **Methods:** Subjective impairments of 355 patients after SAH were examined 32 months after SAH. Aphasia was screened by physicians three times in the acute hospital state and in addition by means of the Token test. The Aachen Life Quality Inventory (ALQI) was employed to assess HRQoL. **Results:** 29 (7.6%) patients had aphasia in the acute stage after SAH. After 32 months their overall HRQoL was significantly worse ( $p < .05$ ). This difference was present in the physical and social main scores. In particular, the aphasic patients complained of more impairments in the following subscales: communication, autonomy, mobility and ambulation. Impairments in communication and autonomy led to the most severe subjective impact in aphasic patients. In close correspondence the proxy-ratings demonstrated a significantly worse HRQoL in the areas of communication, mobility and work. **Discussion:** HRQoL patterns of SAH patients with aphasia in the acute stage are clearly different from HRQoL patterns of those without aphasia. The subjective impairments are most prominent in communication and autonomy. An early standardized diagnosis of aphasia followed by an early treatment is called for, in order to minimize the adverse late sequelae of SAH.

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##### **M. DELAZER, A. GASPERI, L. BARTHA, T. BENKE, & E. TRINKA. Number Processing in Temporal Lobe Epilepsy.**

Specific cognitive impairments have been found to be associated with right and/or left mediobasal temporal lobe epilepsy (TLE), such as deficits in visual or verbal memory, attention or language. However, no attention has been paid so far to number processing and arithmetic in TLE. Deficits in number processing and calculation are severe handicaps in every-day life and exclude patients from a significant part of their culture. Recent models of numerical skills distinguish between abilities which are based on exact processing, such as arithmetic fact retrieval (e.g.,  $3 \times 4 = 12$ ), number fact knowledge (e.g., freezing point of water) or counting, and others which are based on approximate elaboration, such as estimation of numerosities or approximate calculation. It has also been proposed that the processing of approximate quantities is mediated by the inferior parietal lobes, while fact retrieval and counting supported by language-relevant areas. Other authors stress the importance of the temporal lobes for retrieving number fact knowledge. In the present study two groups of patients with unilateral mediobasal TLE performed a detailed neuropsychological assessment as well as a battery of number processing tasks, including exact calculation (simple and complex), approximate calculation, number fact knowledge and timed number comparison. Overall, the left hemispheric group showed more impairments than the right hemispheric group. Importantly, within-subject dissociations were found between preserved approximate processing and impaired exact processing. The present study highlights difficulties of TLE patients often overseen in neuropsychological assessment. Moreover, our results are in line with recent neuropsychological models of number processing.

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##### **V. FOLIA & M.H. KOSMIDIS. Language Laterality in Illiteracy: Semantic Dichotic Listening.**

Several studies have investigated language laterality in illiterate individuals. Some have reported reversed laterality for language processing, while

others have found a lack of asymmetry. These conflicting results may be attributed to the different types of tasks used, as well as to the tasks' sensitivity to phonological processing, a relative weakness among illiterates. We investigated the hypothesis that language laterality is the same in illiterate as in literate individuals, using semantic information. Fifty-four women participated in this study. Nineteen had no formal schooling and could neither read nor write, 20 had a basic education (1–9 years), and 19 had more than a basic education (10–16 years). We administered a dichotic listening test, which consisted of semantically related, phonologically related, and unrelated words. We found that right ear performance (left hemisphere) was equivalent across groups on phonologically related and unrelated word pairs. The most educated group, however, performed significantly better than the illiterate group on the semantically related pairs. Left ear (right hemisphere) performance was influenced by literacy status across conditions. Our results indicated a left hemisphere advantage for language processing in all groups, which was augmented by education, and reduced right hemisphere involvement in illiterates. Consequently, language laterality favoring the left hemisphere appears to be innate but improves with the use of advanced cognitive strategies related to semantic associations with increased education. Comparison of our data to those of other studies suggests that conclusions regarding laterality may be confounded to some extent by the type of task used.

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##### **D. KÖSTER, TH. GUNTER, & S. WAGNER. Online Measures of Semantic Integration of Opaque and Transparent Compound Words.**

In previous research online evidence was found for morphosyntactic decomposition of compound words in online auditory comprehension experiments (Köster, Gunter, & Wagner, 2002). Some behavioural studies (Sandra, 1990; Zwitserlood, 1994) and linguistic theory (Fleischer & Barz, 1995) suggest that at least transparent compound words are also semantically decomposed. (The meaning of transparent compounds is derived from their constituents' meaning.) In the present experiment we manipulated the semantic status of two constituent compounds (transparent vs. opaque; for the latter the meaning is not related to their constituents' meaning) in order to determine the time course of the processing of semantic features. Subjects were presented auditorily with compounds and performed some tasks to ensure that they listen closely while their electrical brain response was recorded (event-related potentials, ERP). As in a previous study we found a slow negative shift in the ERP across the compound word with an N400-like scalp distribution (Kutas & Hillyard, 1980) that was shown to be sensitive to the semantic integration of constituents. This shift was more negative for transparent compounds compared with opaque ones with a maximum at centroparietal electrodes. These results show that semantic processing of transparent compounds requires more resources and, thus, suggests that semantic integration of constituents (after separate constituent access) takes place only in transparent compounds. We argue that this presents evidence against purely memory based models that assume storage of full word forms.

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##### **M. LAUTERBACH, I.P. MARTINS, & K. WILLMES. The Influence of Educational Level on the Performance in Language Testing.**

**Background:** In most neuropsychological evaluation the premorbid capacities are unknown; it raises the question of rating the actual cognitive performance. Concerning language abilities there exist considerable inter-personal differences in language skills, especially in countries with a significant rate of illiteracy. There is evidence that cognitive processing in illiterates differs from that of literates, not only concerning the language

domain. *Method:* During the translation, adaptation and standardization of the "Aachen Aphasia Test" to Portuguese, a population of healthy subjects was being tested with the adopted material. The influence of the educational level in language performance was evaluated in the healthy controls. *Results:* The preliminary results, analyzed for 4 groups of different educational level (illiterates, up to 4 years of education, between 4 to 9 years of education and more than 9 years of education) show marked difficulties for persons with low educational level in processing ambiguous words and sentence constructions and sentences with aberrant word order or uncommon tenses. These results raise the need to develop a correcting factor for the educational level for the application of the Portuguese version of the "Aachen Aphasia Test", in the way this has already been elaborated for the Portuguese version of the "Token Test".

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#### **F. LEFEVER. Verbal and Visual Factors in Russian Word Search With and Without Russian Literacy.**

ORTVIN (Oral Test of Visual Neglect), an English-word verbal-report non-marking analogue of cancellation tests (LeFever, 1991), revealed mainly horizontal normal scan paths and mainly vertical scans in unilateral neglect, both in near and in far space (LeFever, 1992a), altered but still evident when subjects who had read words aloud (ORTVIN) later drew lines between successively detected targets ("Non-directional Trails" or "N-Trails": LeFever, 1992b). A Russian version (RUSORTVIN) was developed not only to test generality of normal *versus* neglect scan paths, but also to compare verbal and visual influences with identical stimuli. Literate readers detecting and reading aloud words beginning with "B" (Cyrillic equivalent of "V") or pointing to them were compared with subjects unfamiliar with Cyrillic letters pointing to a familiar symbol (B) adjacent to subjectively meaningless Cyrillic-letter strings. Differences reflect both helpful and misleading influences of whole-word reading on initial-letter detection, and may be relevant to issues of literacy in cross-cultural or intra-cultural assessment.

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#### **S. NISHIYAMA, M. MATSUI, K. TAJIRI, S. MINAMI, & M. KURACHI. Selective Impairment of Reading in Pure Alexia: A Case Study.**

Several studies in pure alexia have reported that phonograms and ideograms are selectively impaired. However, few studies have taken into consideration complexity of letters. The purpose of this study was to examine the selective impairment of reading in pure alexia considering the number of strokes in detail. Patient was a 66-year old man with pure alexia, associative visual agnosia and right homonymous hemianopia. MRI revealed an infarction in the territory of the left posterior cerebral artery affecting the left occipital lobe and the splenium of the corpus callosum. He presented full IQ of 67 (verbal IQ = 79, performance IQ = 57) and showed pure alexia without aphasia on assessment of the Western Aphasia Battery. We examined the ability to read 46 kanji (single ideograms), 46 kana and 26 alphabet letters (single phonograms) in order to investigate whether phonograms and ideograms are dissociated in oral reading. Statistical analysis of the data demonstrated the reading scores for kanji was significantly higher than that for kana ( $p < .01$ ) or that for alphabet ( $p < .01$ ). The scores for kana were not significantly different from those for alphabet. Moreover, there were no significant differences between the scores for high complexity kanji (>6 strokes) and low complexity kanji (<6 strokes). The present case study revealed that a lesion in the left occipital lobe and the splenium of the corpus callosum does not cause impairment in reading of complex letters but in phonogram reading. We suggest that neural systems are different between phonogram reading and ideogram reading independent of complexity of letters.

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#### **A. PANNEKAMP, A. FRIEDERICI, A. HAHNE, & U. TOEPEL. Electrophysiological Responses to Isolated Prosodic Information.**

Spoken language provides prosodic information which is used by listeners to interpret the speech signal. Only recently, the processing of prosodic information has also been studied by investigating the brain's electrical activity. Steinhauer et al. (1999) used event-related brain potentials (ERPs) to examine the processing of major prosodic phrases in auditorily presented sentences. They used sentences consisting of either one or two intonational phrases. The ERP response showed a positive shift in correlation with the intonational phrase. This was then called Closure Positive Shift (CPS) and interpreted as a reflection of the perception of intonation boundaries. However, up to now it is unclear whether the CPS is determined by prosodic information only. The aim of the present study was to test the brain response on isolated prosodic processing. A corpus of non-speech stimuli was created by humming sentences, so the sentences did neither contain syntactic nor semantic information. Conditions differed in their prosodic realisation: one condition comprised two IPh boundaries, whereas the second only contained one boundary. An ERP experiment with 22 volunteers was conducted. The two conditions elicited significantly different ERP effects. While the condition with the two IPh boundaries evoked two positive shifts, the condition containing one IPh boundary only elicited one positive shift. These results indicate that even prosody on its own is sufficient to evoke the specific brain response CPS. Thus, the existence of syntactic or semantic parameters in the speech signal does not seem to be a necessary prerequisite for the perception of prosodic units.

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#### **E.C. PICKERING & S.R. SCHWEINBERGER. Event-Related Brain Potentials Reveal Three Loci of Repetition Priming for Familiar Names.**

We assessed immediate repetition effects on event-related potentials (ERPs) while participants performed familiarity decisions to written personal names. For immediately repeated familiar names, we observed three distinct ERP modulations. At 180–220 ms, a posterior N200 effect occurred for names preceded by same-font primes only. In addition, an increased left temporal negativity (N250r, 220–300 ms) and a reduced central-parietal negativity (N400, 300–400 ms) were seen both for same-font and different-font repetitions. In a second experiment, when names were preceded by either their corresponding face, or the face of a different celebrity, only the N400 effect was preserved. We suggest that these N200, N250r, and N400 effects reflect facilitated processing at font-specific featural, lexical, and semantic levels of processing, respectively.

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#### **J. RÜSSELER, S. PROBST, S. JOHANNES, & T.F. MÜNTE. Recognition Memory for Words and Unfamiliar Faces in Adult Developmental Dyslexic Readers: An Analysis With Event-Related Brain Potentials.**

Developmental dyslexia has been shown to involve a number of cognitive deficits. The present investigation sought to delineate recognition memory deficits for high- and low-frequency German words and for unfamiliar faces by recording cognitive event-related brain potentials. Twelve adult developmental dyslexics and twelve matched controls were subjected to a two-phase recognition memory test. During the first phase words were presented consecutively with one-third of the words being repeated. The subject had to press buttons according to whether a word had been repeated or not. During the second phase (one hour delay) a second list containing 33% old items from phase one and 66% new words was shown with an old/new-decision required. In each phase half of the new and old words were of high- or low frequency, respectively. In a second recognition memory experiment, unfamiliar faces were used as stimulus material. Recognition memory performance for words was superior for normal compared to dyslexic readers whereas no performance difference between the groups emerged for the face recognition experiment. ERPs of normal as well as dyslexic readers showed a reliable difference between old and new

words. Overall, ERPs for normal readers were more positive compared to those of dyslexic readers indicating shallower processing of the words in dyslexics. ERPs evoked in the face recognition task did not differ for dyslexic and normal readers. These findings are discussed with respect to current concepts of dyslexia and of semantic processing.

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**A. SCHROEDER & R. DE BLESER. Is “Ant” Easier Than “Axe”, and “Butterfly” Easier Than “Ananas”? An Investigation of Age-of-Acquisition Effects in Aphasic Naming.**

This study presents data from German aphasics whose naming was investigated for age of acquisition effects. The age at which a word is acquired has been shown to affect performance independent of other variables like frequency or familiarity in a variety of tasks both in normal and impaired processing. Non-brain-damaged adults recognize and produce words faster and more accurately in auditory and visual lexical decision, picture naming, reading and semantic association and classification tasks. In patients with aphasia or progressive language impairments, age of acquisition has also been shown to predict performance in oral and written picture naming and reading. The aim of the study was to evaluate age of acquisition norms for 255 nouns taken from the Snodgrass & Vanderwart (1980) corpus and to investigate age of acquisition effects in aphasic naming in German. 44 young adults estimated the age at which the words were acquired on a 7-point scale. Inter-rater reliability measured by kappa's concordance and intraclass correlation was highly significant. In addition, significant correlations with existing data bases of estimated and objective age of acquisition were shown. Aphasic naming was examined using different sets of items matched various variables but varied for age of acquisition. In addition, data obtained from larger sets of pictures were analysed using multiple regression analyses. The results will be discussed with reference to the relative impact of age of acquisition and other well-known variables with respect to distinct patterns of aphasic naming.

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**F. SIEBÖRGER, E.C. FERSTL, & D.Y. VON CRAMON. Making Sense of Nonsense: An fMRI Study of Task Induced Coherence Processes.**

A central process for text comprehension is the establishment of coherence, depending on both stimulus properties as well as inference processes. The fronto-medial wall (FMC, medial BA9/10) has been shown to be crucial for coherence building. Because of its involvement in other higher cognitive demands (Theory of Mind, emotional processing, etc.) we hypothesize that FMC activation during comprehension of coherent sentence pairs reflects a domain independent, non-automatic process rather than stimulus properties. The present study aimed at eliciting FMC activation even on the incoherent sentence pairs by a task-induced ‘search for coherence’. Subjects listened to coherent and incoherent sentence pairs and judged the perceived strength of coherence on a 4 point scale (pragmatical relationship graded from ‘directly evident’ to ‘unimaginable’). A pretest showed that participants used their creativity. 61% of the incoherent pairs were indeed rated as somewhat related and the response times for those trials were significantly prolonged. In an event-related fMRI study using the same instruction 12 participants were scanned. For an early stage of processing we found stronger FMC activation for sentence pairs whose coherence was rated as directly evident, replicating the aforementioned results. As expected this was not found for a later stage of processing: during the search for coherence the FMC was equally strongly activated in all conditions. The results are discussed in the context of linguistic and neuropsychological theories.

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**K. STRELNIKOV, T. CHERNIGOVSKAYA, V. VOROBIEV, & S. MEDVEDEV. The Role of Prosodic Clues in Spoken Speech Syntactic Processing. A PET Study.**

It is known that punctuation can influence sentence processing considerably. But most of the studies of syntactic semantics dealt only with the visual presentation of syntactic structures. In the same time pauses and other phonetic cues in spoken language serve the same function of structuring the sentence. We performed a PET study with 12 healthy male subjects to identify neuroanatomical systems, providing the perception of syntagmatic segmentation in Russian spoken sentences. The sentences were chosen so that the place of a semantic pause changed the meaning of the utterance. The experimental design permitted us to independently test the automatic (purely linguistic) and thought-over (metalinguistics) perception of the presented phrases. We found no statistically significant activity associated with the variant of automatic perception. The metalinguistics perception recruited the right posterior inferior frontal gyrus (BA 44) and right cerebellum. The earlier studies associated the right posterior inferior frontal gyrus activation with pitch perception and the right cerebellum activation with verbal fluency and semantic prediction. Thus, we believe that in our study the right posterior inferior frontal gyrus activation reflected the perception of pitch boundaries of the semantic pause. We also presume that the right cerebellum activation in our study is due to the semantic disruption in sentences, caused by the semantic pause. Our results show the dependence of the brain activation on the different presentation modalities, that supports the idea of syntactic processing being not strictly localised in the brain.

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**U. TOEPEL & K. ALTER. How Superfluous and Underspecified Focus Accents Influence Dialogue Perception.**

Two ERP studies are being presented concerned with the online perception of prosody in dialogues. It has been shown quite recently that processing of single sentence structures differs significantly from that of discourse structures. Therefore, the stimulus material in both studies consisted of dialogues conveying narrow new information accents (NF) *versus* contrastive accents (CF). Matching and non-matching prosodic patterns were then created by combining sentences establishing a NF-focus with sentences that conveyed an inappropriate contrastive accent and vice versa. Also, the task requirements varied between the studies. In the first study, participants were asked to perform in a probe detection task, whereas in the second they had to judge the prosodic appropriateness of an answer to its preceding question. EEG data were recorded while subjects listened to the dialogues. Results indicate that the processing of appropriate accent patterns evoke positive-going waveforms in the position of major prosodic boundaries. However, when the accentuation expectancy is being violated, varying task demands change the electrophysiological reaction. In the case of probe detection, ERPs show an enhanced negativity when context implies a narrow focus interpretation, but a sentence constituent is contrastively accented. On the other hand, preliminary data show that the negativity in the prosodic judgment task is increased for constituents that convey narrow new information accents, when context leads to anticipation of a contrastive accent. These results indicate that the very subtle divergence of information prosodically marked new *versus* contrastive modulates recognition in discourse comprehension.

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## LATERALIZATION

**V.J. BOURNE & G.J. HOLE. Integration of Facial Information via Interhemispheric Cooperation.**

Previous research suggests that the right hemisphere is dominant for face recognition, processing the configural information within a face. However



the left hemisphere also contributes to face recognition, by processing featural information. This experiment investigated how the hemispheres might interact in face processing. Faces were manipulated to either disrupt featural information (achieved by blurring the face), or configural information (achieved by presenting the disjointed features of the face). Each face was presented bilaterally, with a blurred version in one visual field and a disjointed version in the other. There were two conditions: facial information was either presented to the specialised hemisphere (i.e., blurred face in the left visual field and disjointed features in the right visual field) or to the non-specialised hemisphere (i.e., blurred face in the right visual field and disjointed features in the left visual field). Participants had to decide as quickly as possible whether each face was famous or not. It was hypothesised that when facial information was unilaterally presented to the hemisphere not specialised for that mode of processing, interhemispheric cooperation would be required to aid recognition. Analysis of reaction times is consistent with this hypothesis: participants were significantly slower to decide whether faces were famous or not when facial information was presented to the non-specialised hemispheres, than when information was presented to the hemispheres specialised for that mode of processing. There were no effects of presentation condition on ultimate accuracy. These findings suggest that interhemispheric cooperation aids face recognition by integrating configural and featural information.

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#### **V.J. BOURNE & G.J. HOLE. Left Hemisphere Recognition of Familiar Faces: Evidence for Featural Processing.**

This experiment considers the role of the left hemisphere in recognising familiar faces, suggesting that the left hemisphere processes the featural information within a face, whereas the right hemisphere processes a face's configuration. Participants were presented with faces that were either complete or had an individual feature removed (i.e., the eyes, nose or mouth). Faces were presented to either the left or right visual field and participants had to decide whether or not each face was famous. When presented to the left visual field/right hemisphere, feature-removal had no effect on recognition speed. In contrast, when presented to the right visual field/left hemisphere, incomplete faces took longer to recognise than complete faces. This effect was largest when the eyes were missing ( $p = .002$ ) and was also significant when the mouth was missing ( $p = .012$ ). Reaction times were not significantly longer when the nose was missing ( $p = .088$ ). This pattern of results suggests that the left hemisphere is involved in face recognition, and that it is specialised in the processing of featural information. The differential effect across facial features when faces were presented to the right visual field is consistent with previous research on the relative importance of each facial feature. The right hemisphere's apparent indifference to missing features is consistent with its specialisation for more wholistic, configural processing. It is suggested that both hemispheres are involved in the effective recognition of a face, but with complementary processing specialisations.

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#### **M. CHAMPAGNE, J.L. NESPOULOUS, & Y. JOANETTE. Characteristics of Right-Hemisphere-Damaged Individuals According to Their Pragmatic Abilities.**

The occurrence of a right-hemisphere lesion can interfere with pragmatic abilities, and particularly with the processing of non-literal speech acts in which the listener has to identify the speaker's intention. The goal of this study was to test right hemisphere damaged (RHD) individuals' ability to process non-literal speech acts and to investigate whether individuals with RHD might show different patterns of performance that need to be better understood. RHD and matched normal controls (NC) were submitted to a cluster analysis which yielded a redistribution of RHD and NC participants into three subgroups (G1, G2, G3) characterized by similar patterns of performance. Group 1 was the most efficient group on all the tests such as comprehension of non-literal language and the Stroop test. G1 contained 11 NC and 4 RHD subjects who were between 38 and 55 years of

age and highly educated, while G3—the least efficient group on the same tests—contained 1 NC and 4 RHD. Participants in this last group were 70 years of age or older with a lower level of education. The current study raises questions concerning the origin of non-literal language comprehension deficits in RHD individuals. Indeed, it may be that such impairments stem from a general cognitive deficit instead of a deficit concerning only the comprehension of non-literal language. A lesion may increase a cognitive pattern of performance which was present before the stroke. Thus, individuals functioning at a high level of cognitive capacity prior to stroke will necessarily show less of a decline compared to those individuals who, prior to their CVA, were already functioning at diminished cognitive capacity.

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#### **R. GÖTTERT, R. BENZ, O. GRÖMMINGER, N. HUCKE, J.M. HUFNAGL, G. MAURER, U. MÜNGBINGER, & U. SCHURI. Is There an Asymmetry of Visual-Spatial Attention in Patients With Unilateral Lesions—in the Absence of Clinical Neglect?**

Routine clinical diagnostics gave an indication that patients without evidence of clinical neglect tend to show reduced visual attention to the side contralateral to the lesion. This was particularly prominent in a test that measures reaction times to visual stimuli in the peripheral visual field under dual task condition ("PVT—Peripheral Perception With Simultaneous Tracking Task", a subtest of the Vienna Test System ART-90). We present data of a sample of patients ( $N > 80$ ) with unilateral lesions due to cerebral infarction, intracerebral hemorrhage or tumor extirpation. All cases with any visual field defects were excluded. The performance on the visual attention test (PVT) was compared with tests of other attention aspects (divided attention, selective attention, speed of information processing) and tests of visual exploration and neglect. A preliminary analysis shows that patients without neglect tend to react slower to peripheral stimuli in the contralesional visual hemifield. The results are discussed with respect to the brain structures affected by the lesion.

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#### **S. LUX, J.C. MARSHALL, K. ZILLES, & G.R. FINK. Differential Hemispheric Activations for Directed Attention to Onset Synchrony and Orientational Congruence.**

We performed an f-MRI study on 14 normal subjects to investigate the estimation of the relative temporal occurrence of two objects (time) and the spatial orientation of the same objects (orientation). We predicted right hemisphere activations for judgments of orientation and left hemisphere activations for judgments of relative timing. Two rhombuses were presented, each 4° peripheral to a central fixation cross, to the right and left visual fields. The orientation of the two figures was either the same or differed by 12°. Furthermore, the rhombuses either appeared at the same time or with an onset difference of 119 ms. In half of the trials, subjects indicated via button press whether or not the rhombuses appeared simultaneously. In the other half, subjects indicated whether or not the orientation of the rhombuses was the same. In half of the trials, subjects responded with their right hand and in the other half with their left hand. The experimental design was thus factorial with the factors TASK (time, orientation) and HAND (left, right) with stimuli being identical across all conditions. Fixation during stimulus presentation was checked using an infrared-based fMRI-compatible eye tracking system (ASL). fMRI data were analyzed using SPM99 on a random effects level. For timing judgments we found activations in the left inferior parietal cortex, left medial frontal gyrus, the left superior temporal gyrus, and the right operculum. By contrast, right superior temporal gyrus activation was found for orientation judgments. These results are consistent with the proposed specializations of the two hemispheres for spatial judgments (right) and attention to time (left).

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**M. MATARÓ, M.A. POCA, M. MATARIN, J. SAHUQUILLO, F. ARIKAN, & C. JUNQUÉ. Dichotic Listening Performance in Patients With Normal Pressure Hydrocephalus.**

Normal pressure hydrocephalus (NPH) is a deteriorating condition characterized by abnormal gait, dementia and/or sphincter dysfunction associated to ventricular dilatation. In addition to ventricular dilatation other cerebral abnormalities have been found associated with hydrocephalus including the morphology and magnetic resonance imaging signal of the corpus callosum. The aim of the present study is to evaluate corpus callosum functioning in a group of NPH patients using a dichotic listening task and to compare it with a group of patients with Alzheimer disease and control subjects. Twenty-three NPH patients, 30 patients with Alzheimer disease and 30 aged controls were included in the study. Of the 23 NPH patients, 19 patients presented an idiopathic hydrocephalus and in 4 it was of secondary type. NPH was clearly associated with left ear extinction. Statistically significant differences were found between NPH patients and patients with Alzheimer disease and control subjects. No significant differences were found between patients with Alzheimer disease and controls. Sixty-one percent of the patients with NPH exhibited left ear suppression, compared to 13% of the patients with Alzheimer disease and 17% of the control subjects. These results suggest corpus callosum dysfunction associated to hydrocephalus.

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**I. PAVÃO MARTINS, C. LOURERO, B. DIAS, S. RODRIGUES, T. FERNANDES, & EPILEPSY GROUP OF HOSPITAL DE SANTA MARIA. The Positive Wada Test: Where Are the Universal Criteria?**

**Background:** There are no universal criteria for positive Wada memory test (PWMT), namely after injection of the PCA. **Objectives:** (1) to propose a criterion for PWMT based on the comparison of the patient's performance on the pre-test (training) *versus* test; (2) to determine and compare the difficulty of training and test in a control group (chronic epileptics); (3) to test the goodness of the criteria based on surgery outcome. **Methods:** Two versions of the test (training and test) were applied to 40 chronic epileptics (mean = 38.38 years old). A crossover design study was used to control learning and interference effects. No difference was found between the two versions ( $t = -0.163, p = .871$ ). The test was also applied to 9 patients, during PCA amital injection, before temporal lobe surgery (8 left, 1 right sided lesion). **Results:** Two patients developed a memory decline following surgery. Several scoring systems and cut off criteria were tested to evaluate the efficacy of the amital results. The majority held low sensibility and specificity. **Discussion:** Clinical report was a better criterion than absolute cut off, which can be explained by an aphasia development, during amital test in some patients. It is necessary to review the criterion of different centres for considering PWT, to define the best criteria. **Correspondence:** *I. Pavão Martins, Language Research Laboratory, Epilepsy Group of Hospital de Santa Maria, Centro de Estudos Egas Moniz, Faculdade de Medicina de Lisboa, Avenida Prof. Egas Moniz, 1649-028 Lisboa, Portugal. E-mail: labling@mail.telepac.pt*

**K. YOSHIZAKI, K. KATO, M. FUTAMURA, A. KOBAYASHI, & T. KAWAI. The Effects of Task Complexity and Sex on the Benefits of Bihemispheric Processing.**

The purpose of this study was to examine the effect of task complexity and sex on the bihemispheric processing using the Posner-type matching paradigm. In Experiment 1, 36 right-handed students were given two tasks. One was that a pair of Japanese Kana scripts which consisted of the same type of phonograms was presented to the unilateral and bilateral visual-fields, so this task corresponded to the Physical Identity task (PI). The other was the same as PI task, except that a pair of Kana scripts consisted of the different types of phonograms. This task corresponded to the Name Identity task (NI). In terms of task complexity, NI task was higher than the PI task. The results showed that while a bilateral visual-fields advantage (BFA) showed up in NI task, it did not in PI. Interestingly, a BFA for female was larger than that for male in the NI task, whereas such a sex

difference in terms of BFA was not obtained in the PI task. In Experiment 2, 32 right-handed students were given two tasks. The tasks and procedures in Experiment 2 were the same as Experiment 1, except that digits printed in Arabic and Kanji numerals were used as targets. The results were consistent with the results obtained in Experiment 1. These results suggested that the benefits of bihemispheric processing enhanced as task complexity increased and that it depended on sex. One possible explanation for such a sex difference could be due to the difference of the size of corpus callosum.

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**N. CHERBUIN, J. BUCHHOLZ, & C. BRINKMAN. Information Integration Between the Cerebral Hemispheres in Normals and Dyslexics.**

In normals, past research has shown that under divided visual field conditions, specific tasks may be processed more efficiently when part of the information necessary to complete the task is projected to each visual field separately (requiring hemispheric interaction) rather than when all necessary information is projected to a single visual field. This is surprising given that when information is divided across visual fields, task resolution involves the extra "cost" of transferring information across the corpus callosum. We investigated the relationship between interhemispheric transfer time (IHTT) and hemispheric interaction between the left and right cerebral hemispheres. We hypothesised that individuals with faster interhemispheric transfer may benefit more from hemispheric interactions than those with slower transfer. Normal individuals ( $n = 60$ ) performed on two tasks: a Poffenberger task, assessing IHTT, and a divided visual field letter-matching task, assessing hemispheric interaction. Results suggest that individuals with faster interhemispheric transfer times show a greater degree of interhemispheric interaction than individuals with slower transfer times. To our knowledge, this is the first time that two separate behavioural measures of IHTT and hemispheric interaction have been shown to be directly and highly significantly correlated ( $r = .47$ ). Since dyslexics have been shown to have interhemispheric transfer deficits, it was expected that they would also present with hemispheric interaction deficits. Research with dyslexic subjects is on going, but early trends seem to confirm lower hemispheric interaction performance. Results from normal and dyslexic subjects will be presented.

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**H. HAETTIG, K. BURCKHARDT, T. BENGNER, & H.-J. MEENCKE. Differential Effects of Temporal-Cortical and Hippocampal Lesions on a Fused-Words Dichotic Listening Test.**

**Objective:** In fused-words (FW) dichotic listening (DL) tests two rhyming monosyllable words are presented simultaneously, each of them to one ear (Fernandes & Smith, 2000; Hattig & Beier, 2000; Zatorre, 1989). There is still a controversy whether this type of DL test is free from contralateral ear suppression (lesion effect). We studied whether a lesion, which involves temporal neocortex affects the DL outcome more than a pure hippocampal lesion. **Methods:** From the Berlin Epilepsy Center the data of  $N = 82$  patients with refractory temporal lobe epilepsies were categorized whether their lesion involved the cortex (temporo-lateral,  $N = 30$ ) or the hippocampus only (temporo-mesial,  $N = 52$ ). Before surgery all patients passed an extended neuro-psychological evaluation, a FW-DL test and a standardized MRI (coronal, sagittal and temporal planes with T1, T2, IR and FLAIR images). **Results:** In the temporo-lateral group we observed a significant effect of contralateral ear suppression on answers from the right ear (REP) in left-sided lesions ( $p = .005$ ). The mean ear values (ear points, left = LEP *vs.* right = REP) for the temporo-lateral group was for left-side lesions LEP = 7.73 *versus* REP = 9.93 and for right-side lesions LEP = 5.20 *versus* REP = 18.93. For the temporo-mesial group the values were: left-side lesion: LEP = 5.21 *versus* REP = 17.47, right-side lesion LEP = 3.00 *versus* REP = 17.47. **Discussion:** The involvement of neocortex in temporal lesions seem to play a crucial role for contralateral ear

suppression in FW-DL tests. In patients with pure hippocampal lesions no such contralateral ear suppression effect was seen. Diverging results in the literature are possibly due to the inclusion or exclusion of patients with lesions in the temporal neocortex.

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## NEUROPSYCHOLOGICAL ASSESSMENT

### **P. BUBLAK, K. FINKE, & W.X. SCHNEIDER. A New Diagnostic Tool for Measuring Attentional Components II: Perspectives for Clinical Application.**

A new diagnostic tool is presented which allows the measurement of four separable components of visual attention: processing speed, working memory storage capacity, spatial distribution of attention, and top-down control. It is based on the theory of visual attention (TVA, Bundesen, 1990, 1998) using whole and partial report of visual letter displays. Single case analyses in brain-damaged subjects favor the assumption that—compared to standard clinical tests—the TVA-based approach improves the possibility to disentangle impaired and intact attentional components. We present further clinical data from a range of neurological and psychiatric patients suggesting that, compared to standard neuropsychological tests, the TVA-based method has critical advantages. For example, the assessment of attention without a motor response component allows testing even severely disabled patients like those suffering from Huntington's disease. Moreover, individually adjustable baseline performance levels improve the comparability with the performance of healthy control subjects. Third, all parameter values are estimated from highly consistent tasks and based on relative instead of absolute performance levels across different conditions. Finally, extraction of four separable parameters assures that a deficit in one attentional component (e.g., processing speed) does not per se influence the measurement of another component and therefore avoids interpretatory ambiguity which often arises when different attentional components are confounded within one task. Taken together, from the first experiences with the TVA-based approach in clinical practice, it appears as a powerful instrument that encourages a more thorough exploration in future research.

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### **J. KOHLER, U. BECK, & B. HOHNECKER. Neuropsychological Assessment of Basic Planning Competence.**

In 1982 Shallice and McCarthy presented the Tower of London Test (TOL) as a new method for detecting planning deficits in patients with neurological diseases. In their initial study involving normal control subjects and groups of patients with anterior and posterior lesions they found that patients with left anterior lesions were shown to be impaired in the number of moves required to successfully complete the task. In the meantime different authors developed a variety of modifications on the original TOL paradigm (overview: Krikorian, 1994). Overall these investigations supported the diagnostic value of TOL for being sensitive to frontal dysfunctions regarding to planning aspects. However there is no standardized test form available which has been developed since yet. Our aim of this study was therefore to develop on the basis of the TOL a standardized test for the basic assessment of planning competence which is able to differentiate between neurological patients with planning deficits and other patients and normal controls. A second aim was to provide a parallel form of the test for retesting patients with planning deficits after a therapeutic intervention. Some effort was also done due to the analysis of the difficulty level of every single task which can be produced within a three pegs-three balls-solution space to provide a graded-difficulty-approach for the test. First normative and clinical data will be presented.

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### **M. PREISS, M. RODRIGUEZ, & J. HORÁČEK. Preliminary Standardization of the Cognitive Estimation Test.**

The Cognitive Estimation Test (CET, Shallice and Evans, 1978) was devised in an attempt to quantify the tendency observed in patients with temporal lobe lesions to produce bizarre estimations to fairly easy questions, despite performing normally on standard intelligence tests. A modification of the Cognitive Estimation Test was developed to assist in the scoring and interpretation of this measure of planning and problem solving. Three studies were presented. In Study 1, the modified CET that required numeric responses was administered to 200 healthy adults. Deviations scores were derived from mean performance of this group. Study 2 found CET deviations scores to be significantly different for patients with schizophrenic disorders relative to a sample of healthy adults. It is concluded that CET and other neuropsychological testing revealed evidence of general intellectual impairment plus deficit in executive function and memory in this sample. Study 3 found similarities and differences in Czech and German samples and conclude a possibility of the CET, "European" version. The normative and clinical data presented are meant to serve as a starting point for further validation of this interesting and new measure. Supported by IGA MZ CR NF 6800-3.

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### **K.K. HEGDE. The Nebulous Promise of Point Estimates.**

Many multivariate techniques utilize the Gaussian Assumptions of normality in data distribution. These techniques become increasingly risky as sample sizes diminish because central limit theorem based assumptions may not be well founded. This is especially of concern when considering the effect sizes typical in social science and medical research. Statistical theory enables researchers to optimise the likelihood of accurately discriminating true signal from noise. The coefficient of variation of sample data, denoted by CV, is defined as  $CV = \sigma/\mu$ . CVs were determined for the participants in a published study on the discrimination of semantic fluency between the following groups: Alzheimer's Disease ( $n = 31$ ), Huntington's Disease ( $n = 14$ ), Parkinson's Disease ( $n = 26$ ), Normal Older Adults ( $n = 25$ ), and Young Normal Controls ( $n = 20$ ). The resultant CVs for verbal fluency were, 0.36, 0.48, 0.52, 0.33, and 0.25, respectively. The resultant CVs for semantic fluency were, 0.39, 0.32, 0.46, 0.23, and 0.19, respectively. Although it is always important to be tentative in accepting preliminary results, and replication is key, conversant researchers should take advantage of the sophisticated statistical techniques available to guide them through the process. When concerns regarding distributional normality arise, further data exploration may be warranted. Using techniques which assume distributional normality with non-normal data may lead to the commitment of major errors in accurately discriminating signal from noise. Computational statistical techniques like the bootstrap and the jackknife procedures allow investigators to check the distributional properties of their data. If data are not normally distributed, the researchers may transform these variables in order to perform further analyses.

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### **C.D. ANDERSON, R.A. LEARK, A.M. ESCALONIA, & C.J. GOLDEN. Discriminant Validity of the TOVA-A: An Initial Analysis.**

The Test of Variables of Attention-Auditory (TOVA-A) version is a continuous performance test (CPT) in use in experimental version. The TOVA-A matches the paradigm of the visual task version (TOVA) with the exception of the stimulus being an auditory tone. Unlike the TOVA, there is little published research evaluating the test's validity. This study was undertaken to examine the ability of the TOVA-A to discriminate between groups of ADHD and normal children. The ADHD group consisted of 66 subjects (mean years of age = 10.27;  $sd = 1.14$ ). The diagnosis of ADHD was made based upon history, clinical parental interview and rating scales, and

was made independent of TOVA-A testing. The 44 normal subjects were randomly selected from the TOVA-A normative database (mean age = 9.57;  $sd = 1.8$ ). Student's *t*-tests yielded group mean score differences on the Response Time Variability (RTV) and *d* prime scales but not for Response Time (RT). Mann-Whitney tests yielded paired ranking differences for the Omission Scale but not for the Commission Scale. A discriminant function analysis was conducted to assess the test's ability to classify subjects. The overall classification rate correctly identified 79.7% of ADHD subjects. Normal subjects were correctly classified 70.5% of the time. While the test accurately classified nearly 80% of the ADHD subjects, the 30% misclassification rate of normal subjects is disappointing; the results are consistent with data from visual based CPTs. The paper further discusses strengths and weaknesses of the test along with suggestions for further research.

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**V.P. BOZIKAS, M. HATZIGEORGIADOU, A. KARAVATOS, & M.H. KOSMIDIS. The Clock Drawing Test in the Greek Population: Normative Data.**

The Clock Drawing Test (CDT) is a measure of visuo-spatial skills, attention and executive functioning that is used widely in various patient groups. It is potentially impervious to cross-cultural differences in test performance. We therefore sought to establish norms for this test, as well as a systematic scoring procedure, for the Greek population. Participants were 100 healthy community-dwelling adults (17–80 years old; 45 women). After a brief interview in order to screen out individuals with a medical history implicating central nervous system changes, we administered the CDT ("free-drawn", "pre-drawn", and three "examiner" conditions; Freedman et al., 1994) and the Mini Mental State Examination (MMSE). A stepwise linear regression analysis showed that age contributed to all five CDT conditions, whereas sex contributed to none. Older participants had lower scores on both tests. Education contributed only to the pre-drawn condition and the last examiner condition (3 o'clock) of the CDT. The former condition is the most challenging of the five. Therefore, it may have taxed the abilities of those with a lower education disproportionately, while for the latter condition this association remains unclear. Performance on all clock conditions was highly correlated with MMSE scores ( $r = .58, .52, .60, .60, .39$ , respectively). The CDT is a simple and easy to administer instrument, which is highly related to other measures of cognitive functioning. Its clinical usefulness leads to the necessity for normative data sensitive to demographic characteristics, such as age and education. Correspondence: Mary Kosmidis, Department of Psychology, Aristotle University of Thessaloniki, 54124 Thessaloniki, Greece. E-mail: kosmidis@psy.auth.gr

**R. BROCKHAUS & Ö. PEKER. Testing Effort in Turkish-Speaking Subjects: Validation of a Translation of the Word Memory Test (WMT).** Because psychometric tests generally represent confounds of cognitive performance and effort, our neuropsychological diagnostic work must include some kind of estimation of the subjects' effort. Suboptimal effort is a major source of variance and must be controlled for. To fulfill this purpose, a qualitatively different sort of psychometric instrument was developed: the symptom-validity-test (SVT). Providing an objective basis for the clinical judgment of effort, an increasing number of SVTs have been employed within the last few years. The Word Memory Test (WMT) is probably the best researched and most often employed of all SVTs worldwide. A validated German translation of the WMT is presently available for neuropsychologists in Germany. This study represents the validation of a Turkish translation of the WMT. A representative sample of healthy, Turkish speaking subjects living in Germany were asked to simulate memory disturbances. None of the subjects was able to produce a valid mnesic profile; their attempt to fake was detected by the WMT. *Results:* The Turkish version of the WMT can be considered equivalent to the original WMT in its ability to objectify negative response-bias in

subjects who simulate memory disturbances or who do not apply optimal effort.

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**J.L. CUNNINGHAM & W.G. BRINGMANN. Unfinished, Unaccepted, but Unforgotten: Koffka's (1939) "Psychology for Neurologists".**

The eminent German-American co-founder of Gestalt Psychology, Kurt Koffka (1886–1941), has been little recognized for his role in the founding of clinical neuropsychology. The present study is an extension of prior work which attempts to assess Koffka's contributions to this now well-institutionalized area of professional psychology. For this purpose, Koffka's final manuscript, provisionally titled, "Human Behaviour and its Modification by Brain Injuries" is reviewed. The book was based on Koffka's clinical work at Oxford University's Nuffield Institute for the Brain-Injured in the period, 1938–1940. While intended as a deliberate effort to bring Gestalt Psychology out of academia into clinical practice, it remained unfinished at the time of his untimely death in 1941. Re-titled by his former pupil, Molly Harrower, "Psychology for Neurologists" Harrower pursued a posthumous publication of the book in 1960. However, she was persuaded against such effort by Hans-Lukas Teuber, foremost neuropsychologist of the time, who saw it as representing "out-dated knowledge". Conducted with the benefit of hindsight, an examination of the reasons for Teuber's decision points to the hegemony of social context in the appreciation of important historical contributions. Achievements made by Koffka were overlooked in the decision, including his arriving at a compelling definition of the essential role of the neuropsychologist in the medical setting. The discussion highlights his specific contributions and concludes with a recognition of the propaedeutic nature of Gestalt holism in guiding various aspects of contemporary neuropsychological practice, including assessment, cognitive intervention, and rehabilitation.

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**C.A. DE JAGER, E. HOGERVORST, M. COMBRINCK, & M.M. BUDGE. Sensitivity and Specificity of Neuropsychological Tests for Mild Cognitive Impairment, Vascular Cognitive Impairment, and Alzheimer's Disease.**

*Introduction:* Early diagnosis of dementia is important for those who might benefit from treatment. We designed a brief comprehensive neuropsychological test battery to help differentiate controls from cases with mild cognitive impairment and dementia. *Methods:* The battery included tests for memory, attention, executive function, speed, perception and visuospatial skills. It was administered to 51 controls, 37 subjects with mild (MCI) or vascular cognitive impairment (VCI), 77 cases with dementia (Alzheimer's disease (AD), vascular dementia (VaD), other dementia syndromes (ODS)) and 12 with psychiatric diagnoses from the OPTIMA cohort. Mann Whitney-U tests were used to compare performance of controls with other diagnostic groups. The sensitivity and specificity of the tests were determined using Receiver Operating Characteristic curve (ROC) analyses. The effects of age, gender and education on test performance were determined with Spearman's rank correlations. *Results:* The AD group performed worse on all tests (except a sustained attention task) than controls. The Hopkins Verbal Learning Test and The Placing Test for episodic memory showed significant discriminative capacity between controls and other groups. Attention and processing speed tests discriminated VCI and VaD from controls. Category fluency, memory tests and the CLOX test for executive function distinguished MCI from AD. Spearman's correlations showed negative associations between age and processing speed. Education affected performance on all tests, except The Placing Test. *Conclusions:* Sensitive and specific neuropsychological tests have been shown to



be helpful in confirming clinical diagnoses for particular types of dementia as well as for early detection of MCI as distinct from VCI.

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**TH. HAID, C. MARTL, F. SCHUBERT, M. WENZEL, M. KOFLER, & L. SALTUARI. The Hamasch-5-Point-Test—Better Normative Data.**

Multidimensional construct “executive functions” include cognitive flexibility, which can be divided into reactive and spontaneous cognitive flexibility (Spreen & Strauss, 1998). The spontaneous component is often evaluated by figural and verbal fluency tests. Clinicians frequently use the Five-Point-Test to assess figural fluency (figural divergent thinking), however, no adequate normative data for this test are available in international publications to date (e.g., Lee et al., 1997). We developed a new version of the Five-Point-Test with well defined instructions, administration, scoring and normative data: the Hamasch-5-Point-Test (H5PT). For normative data we investigated  $N = 290$  healthy adults (mean age 50.9/SD 10.5; range 26–77 years) with a minimum of 8 years of education. Regression analysis showed a significant influence of age and education, but no gender effects on the total number of designs (“Total”) and the number of acceptable designs (“Correct”). Analysis of variance tested two factors: age (I: 26–45; II: 46–57; III: 58–77 years) and education (I: without high-school diploma; II: with high-school diploma). Age and education explained 8% of the variance of “Total” and 12% of “Correct”. Depending on age and education the mean of “Total” varies from 29.3 to 39.4 and of “Correct” from 26.3 to 36.2 designs. The results confirm and extend previous findings in our recent investigation of this test in a smaller number ( $N = 184$ ) of healthy subjects.

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**I. LIEPELT & T. PLATZ. Reliability and Validity of the Berlin Apraxia Test.**

Aim of the ongoing project is to create and validate a comprehensive clinical test battery for apraxia assessment. The Berlin Apraxia test contains subtests for ideomotor limb apraxia, oral (buccofacial) apraxia as well as ideational apraxia. Motor apraxia is assessed with different input modalities: verbal, imitation, and visual. The items remain the same over different input modalities, so subtest performance can be compared directly. The test also differentiates between meaningful and meaningless items. Ideational apraxia is investigated by testing tool-object and tool-action knowledge. Psychometric properties of the test are examined with a sample of 60 stroke patients (40 patients with left and 20 patients with right hemispheric stroke). The validity aspect is investigated by the assessment of associations between the test results and both clinical diagnosis of apraxia and the performance in other psychometric tests (convergent and discriminating validity). The assessment of reliability focuses on internal consistency and retest-reliability.

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**V. MATECHA & P. KULISTAK. Application of Clinical Luria’s System in Everyday Practice.**

In this study the application of Luria’s Clinical System in Everyday Practice is described. Luria’s Clinical System is a medical rehabilitation system which emphasizes neurological and especially neuropsychological rehabilitation. This system consists of several modules, which are partly vertically and partly horizontally connected. Luria’s underlying theory considers the ontogenetic and phylogenetic development of the CNS. In addition, Luria’s division of brain functions into basic and simple modules enables researchers to model neural networks. Luria’s approach has been shown to be useful in the examination, observation and estimation of clinical states in neurosurgery departments.

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**G. PUSSWALD & P. CALÉ. The “Bogenhausen Test of Planning Ability” (BTPA): An Ecologically Valid Instrument for the Assessment of Executive Disorders. Preliminary Data and Further Developments.**

Test instruments commonly used in neuropsychological assessment have been criticized for their lack of ecological validity. The link between functions and abilities in everyday life which are subject to assessment on the one hand, and tasks and test items on the other, often is theoretical in nature and can not easily be communicated to and understood by patients. Moreover, there still is a shortage of instruments for the assessment of executive functions which meets these criteria. The BTPA was first published as part of a diploma thesis (Stoltze, 1991). It was developed as an ecologically valid instrument for the assessment of planning ability in everyday life at the hospital of Munich-Bogenhausen. Initial analyses of data collected with BTPA indicated that the test is easy to be administered; it is discriminative for disorders in everyday planning ability, and test results are highly correlated to the presence of frontal lobe lesions. A regional working group of GNP (clinical neuropsychologists in rehabilitation units in South-Eastern Germany and Austria; “Regionalgruppe Sued-Ost”) in a multi-center study collected BTPA data from patients and control subjects in an attempt to establish standards for the administration of the test as well as normative criteria. The data obtained give indications for a number of test variables which can meaningfully describe disordered mechanisms of planning. In this poster, the BTPA instrument is presented together with data obtained from clinical and control subjects. Implications for further developments of the test are discussed.

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**G.M. HILL, F.M. CLARK, L. NEWTON, & J. LUMSDEN. Cognitive Functioning of Arsonists in a High Security Psychiatric Hospital.**

There is little in the literature characterising the cognitive styles of individuals who commit fire-setting offences. Such studies as do exist tend to describe low overall levels of cognitive functioning and educational attainment. In addition, there are reports of epilepsy and case studies (abnormal photo-paroxysmal responses) effectively treated with anti-convulsant medication. In general those arsonists who are not motivated by purely instrumental reasons (financial gain or covering up another crime) are seen as lacking in effective problem-solving skills and self-control. These findings would suggest that individuals with a significant fire-setting history are likely to have higher incidence of CNS trauma, impaired performance on neuro-cognitive testing and are likely to have lower levels of intellectual functioning than non-arsonist offenders. However, there is little data available to characterise patterns of neuropsychological functioning underpinning these difficulties. In this study, a group of mentally disordered arsonists was compared with a control population (matched in terms of age and psychiatric diagnosis) in terms of their cognitive functioning on a standardised range of neuropsychological tasks. Details of these tasks have been published elsewhere (Lumsden et al., 1998). Tests include a range of general cognitive tasks, tests of memory and frontal lobe functioning. Electroencephalographic (EEG) recording and neuro-imaging data (if available) are also reviewed. The aim of the study is to increase our understanding of this important group of mentally disordered offenders, and tailor suitable treatment to facilitate the reduction of risk in their future care in less secure psychiatric provision.

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**S.R. ROSS, R.A. KRUKOWSKI, S.H. PUTNAM, & K.M. ADAMS. Memory Assessment Scales in Detecting Probable Malingering in Mild Head Injury.**

Despite differences in the constructs measured (Hilsabeck, Dunn, & Lees-Haley, 1996), the Memory Assessment Scales (MAS) remains the most popular alternative to the Wechsler Memory Scales (WMS) as a broad-band instrument for assessing multiple aspects of attention and memory. Although a number of studies have examined indices of the WMS as



indicators of malingering, only one study has similarly investigated the MAS. In a dissimulation study by Beetar and Williams (1995), all major indices of the MAS significantly differed between persons instructed to simulate head injury and control participants. In the current investigation, we examined the degree to which the MAS was effective in detecting malingering in a clinical sample of individuals referred for neuropsychological evaluation after mild head injury. Included in the sample were 21 financially compensable (FC) participants with alleged mild head injury and 21 participants who were not involved in litigation with bona fide head injury. Examination of the four MAS domain indices indicated that Short-Term Memory was most useful at identifying probable malingerers. Additionally, we also examined selected subscales of the MAS. Consistent with previous findings, brief tests such as Verbal and Visual Span had high rates of diagnostic sensitivity (90%) and specificity (81%). Although tests based on a forced-choice recognition paradigm (e.g., Immediate and Delayed Visual Recognition) predicted group membership above chance levels, they failed to significantly add to prediction above Verbal and Visual Span subtests in logistic regression models.

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**S.R. ROSS, S.H. PUTNAM, & K.M. ADAMS. Psychological Disturbance and Incomplete Effort Predicting Test Performance in Head Injury.**

Indices from the Minnesota Multiphasic Personality Inventory-2 (MMPI-2; Butcher, Dahlstrom, Graham, Tellegen, & Kaemmer, 1989) representing disturbance of cognition and emotion and behavioral indices of incomplete effort were examined in relation to performance on the Halstead-Reitan Neuropsychological Test Battery (HRB; Reitan & Wolfson, 1993). In the current study, which included a large sample ( $N = 369$ ) of patients referred for neuropsychological (NP) evaluation after presumptive head injury, select MMPI-2 measures of psychological disturbance accounted for as much as 25% of the variance in individual HRB test scores. When demographic variables, head injury severity, and litigation were entered in previous steps, incomplete effort as defined by chance performance on the Recognition Memory Test (Warrington, 1984) accounted for between 4% and 14% of the variance in HRB test scores. When MMPI-2 indices of psychological disturbance were entered in the last step, they accounted for 5% to 15% of additional variance. MMPI-2 scales demonstrated incremental validity over and above demographic variables, injury severity, litigation, and incomplete effort on all of 13 HRB indices. Although demographic variables accounted for up to 55% of the variance in test scores, litigation and injury severity as measured by duration of post-traumatic amnesia were, at best, modestly related to NP test performance. These results confirm the reliable relationship between test performance and psychological disturbance as well as incomplete effort, but caution investigators about the use of litigation, alone, in predicting NP test performance when assessing the presence of impairment or dysfunction following head injury. Correspondence: Scott R. Ross, Dept. of Psychology, DePauw University, Greencastle, IN 46135, USA. E-mail: srross@depauw.edu

**K. BEECKMANS, R. CLUYDTS, & T. DE BROUWERE. Persistent Cognitive Deficits After Whiplash Injury.**

The present study assessed cognitive functioning in patients with persistent subjective cognitive complaints more than 6 months after whiplash injury (WI). The relationship between emotional and somatic complaints and cognitive functioning was also investigated. Twenty-three WI patients were compared with 20 healthy matched controls. All WI patients had a car accident. They sustained no direct head trauma, loss of consciousness or post-traumatic amnesia. The WI patients were all involved in a litigation procedure. None of them showed malingering as evaluated by the Amsterdam Short Term Memory Test, a recently developed malingering test. WI patients and healthy controls were examined with a neuropsychological test battery to measure attention, speed of information processing, memory, visuospatial abilities and executive functions. Emotional (depression and tension) and somatic (headache, neck pain, and fatigue) complaints were evaluated by means of Visual Analogue Scales. Statistical analysis indicated that the WI group, as compared to healthy controls, was found to be significantly more deficient in sustained, divided and alternating attention, speed of information processing and audioverbal memory (acquisition of new information). No significant deficits could be detected in focused attention, visuospatial memory, visuospatial abilities and executive functioning. A significant negative correlation between depression-intensity and speed of information processing and visuospatial delayed memory performance was also demonstrated.

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**K. GILSTEIN, M. LOVELL, M. COLLINS, M. PELHAM, & M. GILSTEIN. Evaluating an Athlete's Ability to Return to Play Following a Concussion in Children Ages 11 to 14.**

During the past two years, there has been much research in evaluating an athlete's ability to return to play following a concussion. The initial work was done on college and professional athletes, while the more recent research has focused on high school athletes. ImPACT (Immediate Post-Concussion Assessment and Cognitive Testing) is a computer-based evaluation system, which is now widely used throughout the United States and other parts of the world, for this purpose. However, research on norming (and using) this instrument has been done only on athletes ages 15 and above. The current research seeks to expand the usefulness of ImPACT to include middle school aged children. Despite experiencing fewer concussions than older individuals, due to their developing brain, this population is specifically vulnerable to Second Impact Syndrome. This is a result of a second concussion occurring while the brain is still healing from an earlier one. It includes loss of cerebrovascular autoregulation leading to malignant brain swelling, permanent brain injury and, in rare cases, death. This poster will present our research on norming, and using, ImPACT with children 11 to 14 years old.

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**M. MIATTON, C. SACHEM & G. VINGERHOETS. Short Cognitive Profile Examination (SCOPE).**

This is an outline for the construction of a composite bedside diagnostic tool for the assessment of cognitive dysfunctions. Standard neuropsychological assessments to evaluate the cognitive disabilities of a patient requires several hours of formal testing using a substantial battery of neurocognitive tests. For many elderly, physically disabled, or severely ill patients, this procedure is too demanding. On the other hand, mental status screening tests offer little valid information and most short test batteries were developed for specific syndromes, such as dementia. To accommodate the clinical need for a relatively short (<1 hour) bedside, yet complete (covering all relevant cognitive functions) and quantifiable (to evaluate the degree of impairment) neuropsychological instrument, we developed the Short Cognitive Profile Examination (SCOPE). This instrument offers the neuropsychologist an impression of a patient's performance on the following domains: orientation (in person, place, and time), memory (verbal and visual), attention (focused and sustained), language (spontaneous speech, comprehension, naming and word fluency), constructive abilities, reading and writing, left/right orientation, apraxia, and mental flexibility. The use of a general "mental status" score was deliberately avoided to accentuate the evaluation of many different cognitive functions constituting a short cognitive profile. A pilot study was organized in a geriatric population to exclude items that elicit floor and ceiling effects and to adjust possible problems concerning test instructions. Validation and normative studies are in preparation.

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Plenary Speaker 1/9:00–9:45 a.m.

**IMAGING STRUCTURE AND FUNCTION  
OF THE HUMAN BRAIN**

Richard Frackowiak

Plenary Speaker 2/10:15–11:00 a.m.

**GENETICS OF ANXIETY AND DEPRESSION  
IN CHILDREN AND ADULTS**

Dorret I. Boomsma

Plenary Speaker 3/11:00–11:45 a.m.

**LANGUAGE REPRESENTATION  
IN THE BRAIN:  
INSIGHTS FROM ACUTE APHASIA**

Argye Beth Hillis

**Thursday Afternoon, July 17, 2003**

Poster Session 2/1:00–5:00 p.m.

**AGING****A.M. BERARDI & N. RIEFFEL. Effects of Depression on Executive Functions in Healthy Aging.**

Depression is known to affect cognition. The aim of this study was to determine whether depression affects executive functions in healthy elderly subjects to a greater degree than would be expected by age alone. We compared 11 depressed healthy elderly subjects (9 women, 3 men) scoring above 4 on the short version of the Beck Depression Inventory (BDI) and 11 non-depressed healthy elderly subjects (5 women, 6 men) scoring below 4 on the short BDI. The two groups were matched on age and education (both  $F < 1$ ). Three aspects of executive functions were evaluated, namely concept formation (using Raven's Colored Progressive Matrices), planning ability (using the Porteus Mazes) and cognitive flexibility (using the Stroop Color-Word Test). Results were analyzed using ANOVAs with one between-group factor (depressed vs. non depressed healthy elderly subjects) and one within-group factor (the score on each test). Depressed healthy elderly subjects had lower scores than non depressed healthy elderly subjects on planning ability ( $p = .04$ ), and marginally on concept formation (Raven's total:  $p = .09$ ). Depressed and non-depressed healthy elderly subjects did not differ on cognitive flexibility (Stroop Part1, Stroop Part2, and Stroop Part3: all  $F < 1$ ). These results suggest that depression in healthy elderly subjects affects concept formation and planning but not cognitive flexibility. Hence, at least for some aspects of executive functioning, depression adds further impairment to that usually observed as a consequence of healthy aging.

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**J. COCKBURN, J.E. BOYD, & C. HARLEY. Maintaining Postural Control When Seated: Measuring Cognitive Demands.**

Evidence is growing that simultaneous attention to a cognitively demanding activity, such as repeating a string of digits, disrupts postural control in older adults, which suggests that the two activities are competing for central attentional resources. A reduction in automaticity of postural control with age is therefore hypothesised. However, the extent to which the motor component of vocalisation may confound competition from cognitive demand has not been clarified. Data reported here are preliminary findings from a study of resource allocation in sitting balance. Twenty-six volunteer participants, with no history of neurological damage, aged between 60 and 81 years (mean MMSE score 27.77, SD 1.53), were asked to sit as still as possible on a balance platform for six thirty-second trials. On two trials they focused solely on sitting, on two they were asked to generate words to a given category (e.g., girls' names), and on two to repeat 'baa' for discrete 8-second periods. Balance was measured as the area of sway around the centre of pressure. We predicted a greater divided atten-

tion cost (proportional increase in sway area during sitting plus speech from silent sitting), indicating greater cognitive load, for category generation than for repetitive vocalisation. This prediction was supported (Wilcoxon  $Z = 4.37$ ,  $p < .001$ ). Therefore, attention to a cognitively demanding activity reduces resources available for postural control notwithstanding some effects of motor speech, even in healthy older adults. Data are currently being collected from patients early after stroke to examine resource allocation while relearning balance control.

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**C.M. DE FRIAS, R.A. DIXON, & E. STRAUSS. Executive Functioning Relates to Memory Compensation Strategies in Healthy Older Adults.**

Indicators of executive function (EF) are associated with aging-related and population-specific decrements in cognition, including memory. Using a cross-sectional sample of relatively healthy 55–85 year-old adults ( $N = 427$ ), we examined whether concurrent EF was related to self-reported efforts to compensate for normal memory decrements. Data for this Victoria Longitudinal Study sample included multiple indicators of EF (viz., derived from Color Trails, Hayling Sentence Completion, Stroop, and Brixton) and the Memory Compensation Questionnaire (MCQ; viz., five memory compensation mechanisms; two general dimensions of commitment and awareness). Analyses were conducted at both the individual indicator and structural levels. Regression analyses showed that, after controlling for age, gender, and education, increased errors (Brixton) was associated with greater use of both external and internal compensatory strategies. Most revealing were structural analyses (LISREL 8.3) with an underlying EF latent factor of latency scores ( $2 = 14.98$ ,  $df = 6$ ,  $p < .05$ , RMSEA = .06, CFI = .98, GFI = .99). Notably, poorer structural-EF performance was related positively to compensatory reliance on others; ( $2 = 1358.42$ ,  $df = 684$ ,  $p < .05$ , RMSEA = .05, CFI = .83, GFI = .86) and to both of the general dimensions of commitment to compensate and awareness of increasing need to compensate ( $2 = 157.95$ ,  $df = 98$ ,  $p < .05$ , RMSEA = .04, CFI = .97, GFI = .96). Large-scale, multivariate studies can reveal that even subtle early cognitive declines in healthy older adults may be reflected in detectably lower EF performance and selective increased use of memory compensation techniques.

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**C.M. DE FRIAS, R.A. DIXON, E. STRAUSS, & S.W.S. MACDONALD. Structure of Executive Functioning Tests in Healthy Older Adults.**

In both research and clinical practice, executive functioning (EF) is commonly measured with a small set of tests selected from a broad range of possible indicators. To what extent do EF tests share common variance and reflect a single construct? We examined the factor structure of a

combination of 14 EF indicators using data from a new cross-sectional sample of 55–85 year-old healthy adults ( $N = 440$ ) from the Victoria Longitudinal Study. Confirmatory factor analysis (LISREL 8.3) was used to determine the dimensionality of the EF battery, which included multiple indicators from Hayling, Stroop, Brixton, and Color Trails tests. Initial models testing the structure of errors and interference indices failed to converge on a single latent EF factor. Alternatively, modeling 6 individual latency indicators fit a single factor (chi-square = 14.98,  $df = 6$ ,  $p < .05$ , RMSEA = .06, CFI = .98, GFI = .99; loadings ranged from .3 to .7). Testing a higher-order single-factor model, with each of the 6 measures defining a first-order factor, resulted in similarly excellent fit. Subsequently, examining structural relations among the EF factor, age, and vocabulary (chi-square = 35.04,  $df = 16$ ,  $p < .05$ , RMSEA = .07, CFI = .96, GFI = .97) showed that poorer EF performance was related to older age and lower vocabulary. Discussion focuses on healthy aging and (a) the extent to which EF tests reflect a common construct, (b) the potential benefit of a multiple-indicators approach, and (c) distinctiveness of EF from general intellectual ability.

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#### **B.P. HERMANN, M.A. SAGER, & J. COOPER. Accelerated Aging Effects in E4+ Children of Patients With AD.**

Early detection of Alzheimer's disease (AD), or factors that predispose to AD, is of importance now that therapeutic compounds are becoming available. This investigation attempted to detect accelerated cognitive aging effects in an at-risk population, i.e., middle-aged individuals with a parent with AD. Patients with AD met NIH and DSM-IV criteria and their adult children (age 40+) were recruited for investigation and underwent medical, neuropsychological and genetic (APOE) assessments and were divided into [4+ ( $n = 35$ ) and [4- ( $n = 32$ ) groups. There were no significant differences between [4+ and [4- groups in clinical and demographic characteristics (age, education, gender, IQ, depression scores) or comorbid medical or psychiatric conditions. Subjects were administered a comprehensive neuropsychological battery assessing intelligence (verbal, performance), language (naming, fluency), visuospatial perception (spatial orientation, construction), memory (immediate and delayed verbal and visual memory) and executive function (set shifting, response inhibition, problem solving). The relationship between age and cognition was examined within [4+ and [4- groups to search for evidence of accelerated aging effects using Spearman correlations. [4+ subjects showed significantly ( $p < .05$ ) poorer performance on measures of executive function (response inhibition, set shifting) and verbal memory (immediate, delayed and recognition memory) with increasing chronological age, an effect not observed in [4- subjects. There were no significant age-related differences between the [4+ and [4- groups across measures of intelligence, language, or perceptual skills. These cross-sectional findings suggest that [4+ children of patients with AD may constitute an at-risk group for accelerated aging effects in memory and executive function.

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#### **J. LEVY-BENCHETON & K.Z.H. LI. Measuring Executive Functioning in Older and Younger Adults.**

There is a mounting interest in the investigation of age-associated cognitive decline in executive processes (e.g., inhibition, dual-tasking, problem solving, and cognitive flexibility). Age differences in executive functioning (EF) have been assessed by means of both neuropsychological and experimental tests. Bryan and Luszcz (2000) caution that neuropsychological tests of EF may be less informative when assessing sub-clinical levels of impairment. Our study addresses this concern by comparing an experimental test of EF (dual-task memorizing and colour decision) with standardized tests (Stroop interference, Self Ordered Pointing Task [SOPT], Excluded Word Fluency [EWF]) in healthy older and younger adults. Dual-task cost (DTC) measures revealed a significant effect of age. This

age main effect was qualified by an Age Group  $\times$  Task interaction ( $ps < .01$ ), showing qualitative differences in relative task emphasis between groups. The neuropsychological tests show a diffuse pattern. The old performed worse than the young on the SOPT ( $p < .05$ ) and Stroop interference ( $p < .001$ ), but not on EWF. Although EWF alone did not discriminate groups, individual differences analysis of this measure in relation to dual-task performance was informative: The pattern of significant correlations ( $ps < .05$ ) between DTCs and EWF underscores the differential task emphasis present for older adults only. For young adults, memory DTCs were positively correlated with EWF scores, illustrating a sensitivity that could potentially discriminate levels of EF in younger adults. Consideration of both group and individual differences, and of differential strategy use, appears to be important when assessing executive functioning in healthy older adults.

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#### **S.W.S. MACDONALD, D.D. GARRETT, R.A. DIXON, & D.F. HULTSCH. Subclinical Cognitive Impairment in Older Adults: Stability of Classification?**

Receiving increasing attention in the study of otherwise healthy aging is a broad range of phenomena reflecting Cognitive Impairment with No Dementia (CIND). Recent research has improved the definition and scope of CIND criteria, and expanded our understanding of clinical implications and behavioural sequelae. A key goal is to develop a consensus classification scheme that distinguishes between normal cognitive changes and cognitive impairment reflecting emerging neurodegenerative changes. To this end, we examined longitudinal data on change and stability of CIND classification as a function of cognitive domain and precision of scheme. Adults (initially aged 55–85 years;  $n = 440$ ; MMSE  $> 24$ ) who participated in three waves of the Victoria Longitudinal Study (VLS) were used. First wave CIND classification was based on a score of 1+SD below the mean on any of 14 cognitive measures (including memory, reasoning, vocabulary, perceptual and verbal speed). Logistic regression analyses differentiated CIND and non-impaired groups (across all three waves) on the basis of MMSE score ( $p < .01$ ). Stability coefficients varied according to the precision of the classification scheme. The least exacting criteria, requiring impaired performance on successive waves for any cognitive domain, yielded high stabilities ( $r = .63$  to  $.72$ ; 85–89% maintaining status across all intervals). The most precise criteria, requiring impaired performance in specific domains on successive waves, resulted in wide variation in stabilities ( $r = .38$  to  $.72$ ; 47–90% maintaining status across all intervals). We discuss clinical and theoretical implications of CIND classification as a function of retest interval, cognitive domain, and precision of criteria.

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#### **F. RIBEIRO, M. RODRIGUES, C. LOUREIRO, M. GUERRIERO, I. PAVÃO MARTINS, T. MARQUES, & A. LOUÇÃO. Verbal Learning and Age: Effects of Attention and Executive Function.**

The California Verbal Learning Test (CVLT) involves learning a list of words from 4 semantic categories. It gives measures of learning, retention and retrieval of verbal material. Memory complaints are very common in adults above 50 years of age. Age related changes in memory have been related to frontal functions namely attention and executive function strategies. These relations were studied using well-known tests for these cognitive functions. We present data from a sample of healthy participants tested for memory, attention and executive function. Participants also responded to a subjective memory questionnaire. *Objectives:* 1) To analyze the effect of several demographic variables on the CVLT. 2) To study the relationships between the CVLT indices and measures of attention, executive function and memory complaints in the adult population. *Methods:* Our sample consisted of healthy participants aged between 25 and 70 years functionally independent. Memory was assessed with the CVLT,



attention with the Toulouse-Piérion test and executive function with the Trail Making Tests A and B. Memory complaints were investigated with the Subjective Memory Complaints Questionnaire. **Results:** Preliminary results obtained in 53 participants aged from 26 to 64 showed no significant relationship between subjective memory complaints and any of the studied measures. Age and education showed significant correlations with the following measures: attention (number of marked symbols minus errors and omissions), executive function (time for Trail A and B) and memory (measures of free recall). This may reflect the expected slowing and recall modifications related with aging.

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#### **A.I. TRÖSTER & J.A. FIELDS. Apolipoprotein E Genotype and Memory in Healthy Elderly and Parkinson's Disease.**

The Apolipoprotein E (ApoE)  $\epsilon 4$  allele probably confers increased risk for Alzheimer's disease (AD), but its role in memory function remains controversial. Whereas some studies report an association between  $\epsilon 4$  and episodic memory among elderly, others do not. ApoE genotype and impoverished memory may thus be independent risk factors for AD. ApoE genotype does not confer increased risk for dementia in Parkinson's disease (PD). However, if ApoE has a direct influence on memory, one might expect memory to be poorer among PD patients with than without  $\epsilon 4$  alleles. The California Verbal Learning Test (CVLT) performance of 44 healthy elderly with at least one  $\epsilon 4$  allele was compared to that of 102 similarly aged and educated elderly without  $\epsilon 4$ . The  $\epsilon 4$  group showed significantly poorer immediate and long- (but not short-) delay recall. Semantic clustering was diminished, suggesting a role of shallower encoding in the  $\epsilon 4$  group's poorer recall. In contrast, the CVLT performances of 42 non- $\epsilon 4$  and 20  $\epsilon 4$  PD patients did not differ. When age and gender were covaried, a trend toward slower learning was observed in the PD- $\epsilon 4$  group. Results suggest that either ApoE genotype and impoverished memory are independent predictors of dementia (AD), or that PD sets in motion a pathophysiologic cascade that masks subtle memory changes associated with Apo-E genotype. The possibility that persons with the very earliest stages of AD (and subtle memory impairment) are overrepresented in the  $\epsilon 4$  group cannot be excluded, but this would not explain the differential impact of ApoE genotype on memory in healthy elderly and PD.

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#### **W. WALKER, M.L. DREXLER, A. ZIKOULI, H. KAZAZI, & K. GEROULANOU. Greek Speakers: Influence of Age on the Color Trails and the Five-Digit Tests.**

Examined the influence of age and education on the Greek version of the Color Trails Test (CTT) and the Five-Digit Test (FDT) on 49 subjects recruited in Greece. The average age was 26, and the average years of education was 17. Clinical utility for cross-cultural assessment in diverse areas is discussed. The purpose of the present study was to examine the influence of age and education across scores on the CTT and the FDT in a Modern Greek-speaking sample. Subjects included 49 individuals recruited utilizing a snowball sampling technique in Xylocastro, Greece. There were 25 women and 24 men. The average age was 26 years ( $SD = 5$ ). The average educational level was 17 years ( $SD = 4$ ). The complex relationship between age, years of education and performance across the subtests of the CTT and the FDT was studied, and a preliminary examination of normative implications was explored. Because cross-cultural assessment is so important, the development of this test may be relevant to those who assess patients in linguistically and culturally diverse areas such as Europe. None of the subjects declined to continue once testing had begun, and many expressed an interest in the test. The test was well received by all subjects. In addition, the tests are both relatively brief and easy to administer. Suggestions for future research are given, particularly in more

educationally diverse samples, and the clinical utility of the test for cross-cultural assessment is discussed.

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#### **J. CHUNG. A Validation Study of the Adult Sensory Profile for Chinese Older Adults.**

Sensations are primary building blocks of behaviors. Without appropriate inputs and processing of sensory information, behaviors become disorganized. Sensory overload and sensory deprivation have been hypothesized to explain for challenging behaviors such as apathy and aggressive behaviors. Problems of sensory integration have been widely discussed in the pediatric population such as autism. However, little is known about the sensory functioning and processing of older people, especially those with cognitive impairments. One plausible reason is the lack of an appropriate instrument to measure sensory functioning of older people. The Adult Sensory Profile (ASP; Brown et al., 2001) was developed based on Dunn's (1997) model of sensory processing. This 60-item instrument measures six sensory areas on a five-point scale, and the results are used to indicate four types of sensory processing: sensory sensitivity, sensation avoiding, low registration and sensation seeking. This study evaluates the psychometric properties of the Chinese version of Adult Sensory Profile (CASP) as a measure of sensory processing for Chinese older people. The CASP was firstly translated, and amendments were made after pilot testing on older people, and backward translation. Secondly, the cultural relevancy of content, and translation of the CASP are examined by an expert review panel consisting of geriatricians, psychologists, and rehabilitation therapists. Thirdly, item reliability and factor analysis are performed with a group of healthy Chinese older people. Results of the last two parts will be discussed for its appropriateness and relevancy as an instrument to measure sensory functioning and processing of Chinese older people.

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#### **E. ITO, Y. ITO, & T. HATTA. Life Style and Verbal Fluency Performance in Healthy Aged People.**

The relationships between cognitive function and lifestyle were investigated in a rural cohort in Japan. Four hundred and thirty community dwellers aged from 38 to 91 years old participated in this research survey. Participants were given verbal fluency tasks (letter fluency and word fluency) to evaluate their cognitive function. Participants also answered the questionnaire to ask about their family structure and life style (habits of practice, hobby, etc). The results strongly suggest that the level of cognitive ability relates to the style of living. That is, high performers in cognitive task were enjoying verbal hobbies (reading, poetry, Japanese verse of thirty-one syllables), music, and physical-practice such as walking. The relations between verbal fluency task performance and the hobby of hand-finger movement type such as knitting and cocking were lower than the hobby of physical practice type. The richness of mutual conversation among family members also relates to the verbal fluency performances.

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#### **Y. ITO & T. HATTA. Cognitive Function and Limb-Kinesthetic Ability in Healthy Aged People.**

The relationships between frontal hemisphere function and limb-kinesthetic ability in healthy aged people were investigated. Five hundred and thirty-four community dwellers in a rural cohort in Japan aged from 38 to 89 years old participated in the experimental study. All participants were given the D-CAT (digit-cancellation test), the letter fluency test and Stroop test. The muscular strength measurement was done by the Strength-Ergo (Mitsubishi Electric). The results showed that there were significant high correlation between one, two, three digit cancellation performance and muscular strength. The correlation between Stroop test and muscular



strength was not significant. Based upon these results, the role of subcortical motor area and cerebellum on frontal hemisphere function is examined. Correspondence: Takeshi Hatta, Dept. Psychology, Graduate School of Environmental Studies, Nagoya University Furoh-cho, Chikusa-ku, Nagoya City, 464-8601, Japan. E-mail: thatta@info.human.nagoya-u.ac.jp

**O.L. REY, L. MURRAY, & K. GAITLEY. Effects of Normal Aging on Linguistic and Non-Linguistic Executive Functions.**

Effective function is a coordinator cognitive system that regulates neuropsychological abilities to mediate adaptation between individuals and their changing environment. Most research on executive functioning has focused on measures of working memory, planning, and inhibition, with little examination of executive aspects of language such as pragmatics, inferential reasoning, or contextual language use. Investigation of these latter aspects of executive functioning is important when studying cognitive changes in normal aging, as previous aging research has documented executive decline but relatively preserved basic linguistic abilities. To assess this discrepancy we evaluated a younger ( $x = 32.74$  years) and older ( $x = 73.18$  years) group of healthy adults with high education ( $>17$  years), utilizing a protocol of linguistic and non-linguistic executive function tests. Linguistic measures included interpretation of ambiguous sentences and figurative language, pragmatics, and appropriate use of vocabulary in context. Non-linguistic measures assessed inhibition, planning, visual working memory, and cognitive flexibility. Results showed that elderly subjects obtained significantly lower scores on non-linguistic versus linguistic tasks, whereas younger subjects showed no such difference. Between group comparisons indicated that elderly subjects consistently obtained lower scores on all non-linguistic tasks, but both groups displayed similar performance in contextual language use. A regression analysis showed age as a good predictor of performance in tasks requiring inhibition, working memory, and cognitive flexibility, but not in the linguistic tasks. These results suggest a dissociation of executive abilities dependent upon the characteristics of the task and the cognitive demands of the environment.

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## ATTENTION

**M. JUNCADILLA, I. DE LA FUENTE, N. BUSQUETS, M. HERNÁNDEZ, F. RUBIO, & C. JUNQUÉ. Attention and Information Processing in Subcortical Vascular Lesions.**

**Objective:** To assess the development of attentional and information processing deficits in patients with subcortical vascular lesions taking the type (ischemic or hemorrhagic) and location (caudate+putamen, putamen, pallid+thalamus; right hemisphere or left hemisphere) of the lesion. To study the relationship between these data and functional neuroimaging (SPECT). **Patients/Method:** We studied a sample of 47 patients (39 men, mean age = 54.3, SD = 14.6) with a single subcortical lesion and without previous psychiatric or neurologic disturbances. Patients were evaluated three times (between 3 and 7 days, at 3 months, and 12 months after the stroke). CT was carried out a few hours after the CVA; MRI was conducted between the third and fourth month; the first SPECT was done between the first and second week, and a second SPECT at 12 months after the stroke. **Results:** Forward and backward digit span was more affected in left lesions. Backward digit span was the most affected, although it improved over time ( $p = .038$ ). Mental control was preserved. The time of performance of Stroop test was less than in patients with putaminal lesions ( $p = .001$ ). Information processing (PASAT test) was affected in all groups, but it improved in two explorations ( $p = .006$ ). Scores in backward digits are related to frontal hypoperfusion which was caused by lesions of caudate+putamen. Unilateral neglect is related to temporo-parietal hypoperfusion. **Conclusions:** We observed significant correlation between location of the lesion and some studied variables, while no significant effect was found with the type of the lesion.

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**K. LAMPE, R. HILSE, K. SCHNELL, K. BONGARTZ, Ch. PRÜTER, S. KROENER, I. JÜTTE, & S. HERPERTZ. Specification of Neuropsychological Deficits in Patients Suspected of Adult Attention Deficits/Hyperactivity Disorder (ADHD) Compared With Healthy Controls.**

**Goals:** Data from literature show that about one third of children diagnosed with attention deficit/hyperactivity disorder (ADHD) continue to exhibit the disorder as adults. Unlike children who display problems monitoring their behaviour, adults have difficulties in cognitive controlling, a finding which is of diagnostic significance. Parting from Posner and Raichle's theory and the ANT test derived from it to assess three mutually independent attentional networks, this study focuses on alertness, orientation and executive functions of attention. It is assumed that there are subgroups within the ADHD group. First, indices suggest that a larger group shows impairment of alertness or sustained attention and of executive functions (with longer reaction times and a higher number of errors in the corresponding tasks), while the smaller group shows impaired orientation, as evident by slower reactions. Furthermore, it is also assumed that a subgroup of patients has difficulties in inhibition tasks (behavioural and/or cognitive inhibition), as could be revealed by a higher number of errors during a stop signal task, longer reaction times during a Stroop test, as well as shorter reaction times during an "ignored repetition" condition of a negative priming paradigm. **Method:** A total of 60 subjects matched for age, gender and education were divided into two groups of 30 subjects each to test the attention functions on a test battery. **Conclusions:** Preliminary statistical analysis marginally supported the hypothesis that the ADHD group can be divided into two subgroups as described above. On basis of these results, we discuss the optimizing of diagnostic from adult ADHD (arrangement of a valid neuropsychological test battery).

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**F. LEFEVER. Visual Neglect: Deficit in Effect of Goal, Not Spatial Working Memory.**

A major contribution of spatial working memory deficits to unilateral visual neglect has been claimed on the basis of (1) impaired spatial working memory in patients with right-hemisphere lesions and unilateral neglect, and (2) reduction of neglect in some cases with cancellation-type tests with verbal or verbally codable and unique target items instead of identical letters or symbols distinguished only by spatial location. This is controverted by data from a longer series of patients using a verbal-report non-marking analogue of cancellation tests for neglect. As with a recently-reported verbal report test (Samuelsson et al., 2002), it shows typical horizontal normal scan paths and irregular but mainly vertical paths in neglect, but its target items are whole words with a specified initial letter, unique and easily kept in verbal working memory (in some cases, non-spatial visual imagery also). The reported return to targets already detected, cited as spatial working memory failures are seen in the verbal test also; moreover, patients often comment that they are reporting the same target again. This is better understood in the context of "overmarking" in Digit Symbol tests and other failures to "appreciate" goal achievement or task completion behaviorally, despite verbal "knowledge" of it, in patients with right-hemisphere lesions (LeFever, 1989).

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**F. LEFEVER. Search Paths in a Spanish-Word Version of an English Verbal-Report Neglect Test.**

ESPORTVIN, a Spanish-language version of an English "oral test of visual neglect" (ORTVIN) was developed to explore generality of normal (mainly horizontal) and unilateral-neglect (irregular and mainly vertical) search patterns in Spanish-speaking and Spanish-English bilingual subjects. ORTVIN has yielded scan-path information comparable to that obtained with expensive oculographic recording equipment but requires only an audio recorder, more accessible in less-affluent countries and communities. Decreased daily reading by immigrants to non-Spanish-speaking

countries (expense of prescription eye-glasses, decreased casual exposure to Spanish text, etc.) may alter "normal" scan patterns. ESPORTVIN may be useful beyond unilateral neglect assessment, e.g., in qualitative analysis of "decreased" visual exploration in Alzheimer's disease.

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**M. RIOS, J.M. MUÑOZ-CESPEDES, J.A. PERIAÑEZ, & N. PAUL. Executive Control and Speed of Processing: Attentional Performance After TBI.**

Attention disorders are a major problem after traumatic brain injury (TBI) underlying deficits in other cognitive functions and in everyday activities, hindering the rehabilitation process and the possibility of return to work. Functional neuroimaging and neuropsychological assessment have depicted theoretical models considering attention as a complex and non-unitary process. In this study a sample of severe TBI patients and normal controls were assessed using three neuropsychological tests (WCST, TMT, and Stroop Test) in order to identify what cognitive mechanisms underlie its performance, and what kind of impairment occurs after a severe TBI. Two are the main hypotheses to explain these attentional disorders: some studies demonstrate specific deficits for different attentional processes, while others suggest a general slowness of information processing. The use of factor analysis, *t* and *U* tests of differences, and covariance analysis, allowed to clarify the importance of slowness in TBI patients' difficulties. The present data partially supports the slowed processing interpretation since controlled processing or supervisory strategies is also required to perform some of these tasks. A Principal Components Analysis provided a four-factor solution that explained 89.6% of the variance: I. Cognitive flexibility; II. Speed of Processing; III. Interference; and IV. Working Memory. The data suggests that the control process of attention might be considered as a group of separable capacities. These results have important implications for Neuropsychological assessment and rehabilitation of TBI patients.

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**C. SCHÜTZE & H. HILDEBRANDT. Unilateral Neglect and the Estimation of the Body Midline.**

Unilateral neglect is a disturbance of spatial behavior resulting in the fact that the patients do not respond to contralesional stimuli. Recent theories suggest that the neuronal transformation of sensory input into non-retinal coordinate systems is impaired and therefore the egocentric frame of reference is (referred to the observer) shifted around the vertical body midline towards the ipsilesional space (Karnath, 1997). In a simple experiment, patients with right brain damage and pure unilateral neglect (excluding patients with additional hemianopia), and healthy control subjects as well, were asked to estimate their body midlines. Two experimental conditions were carried out: the subjects should mark the midline (a) with their eyes kept open (visual control condition) and (b) without visual information (proprioceptive). The difference between the groups was significant only in the visual control condition, but not in proprioceptive estimation. Furthermore, there was no correlation between the two conditions. Correlations with clinical neglect tests (star cancellation, a visual search task etc.) were found only for the visual control condition, but not for the proprioceptive. There was no evidence for a systematic shift in the egocentric frame of reference and therefore the question on which level of spatial information processing hemi-inattention occurs primarily will be discussed. Correspondence: *Cathleen Schütze, University of Bremen, Institute for Human Neurobiology, Argonnenstrasse 3, 28211 Bremen, Germany. E-mail: cathleen.s@gmx.de*

**D. SENKOWSKI, S. RÖTTGER, S. GRIMM, & C.S. HERRMANN. Bottom-Up Processes Capture Attention in Visual Feature Binding.**

Linking together and integrating separate features of a single object in the correct combination is one of the most important functions of visual binding. It is a long-standing debate whether visual binding is affected by an automatic bottom-up process, or whether binding processes require top-

down modulated selective attention. Here we present a series of four experiments employing Kanizsa figures to investigate the temporal order of binding and attention. The perception of Kanizsa figures requires the binding of separate features to a single figure. In two visual search tasks we found that Kanizsa figures "popped out" of the display when they were presented among distractor stimuli. In two further EEG experiments we found that the same Kanizsa figures could act as cueing masks for a subsequent choice-reaction task, as indicated by larger posterior N1 amplitudes for validly cued trials. These results demonstrate, that binding can occur during early bottom-up processes, thereby capturing attention.

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**M. VAN ZANDVOORT, J. TER WAL, E. GROET, M. WEBELING, A. KAPPERS, C. DIJKERMAN. Disturbances of Haptic Spatial Representations in Patients With Hemispatial Neglect.**

Previous studies have shown that when normal subjects are asked to haptically match the orientation of two bars in a horizontal plane, subjects often make large systematic errors. These errors vary with the orientation of the hand that is used to rotate the bars, suggesting a bias towards a hand-centered egocentric frame of reference. We assessed whether these systematic deviations, indicative of egocentric hand representations, were also present in patients suffering from hemispatial neglect. Five neglect patients and ten age- and gender matched healthy control subjects were asked to match the orientation of an unseen reference bar by rotating a second test bar using touch alone. The test and the reference bar could be placed in the left, right or central space. The task was performed with the right hand only. The control subjects consistently showed the expected hand-related deviations. The neglect patients made larger and more variable absolute errors. In addition, they did not show the hand-related deviations found in the control subjects. The data suggest an impairment in the use of egocentric hand-centered frame of reference during haptic exploration of extra-personal space. Further research should assess whether this is specific for patients with hemispatial neglect, or whether it is a consequence of an impaired body representation related to unilateral sensorimotor impairments and would therefore be present in all hemiplegic patients.

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**J. ARRINGTON, D. NEMETH, J. HAMILTON, & K. GEIGER. Data of Fraternal Twins, Age 9, Both With ADD/LD and 1 With Spina Bifida.**

Fraternal 9-year-old twins were referred for comprehensive neuropsychological/psychoeducational assessments. Extensive evaluations, including intellectual, educational, attentional, neuropsychological, behavioral, and affective measures, were administered. As the younger twin was born with spina bifida, he was referred by his pediatric neurosurgeon through the local hospital spina bifida clinic and also by his pediatrician. As the older twin was previously diagnosed with ADHD and was receiving 72 mg of Concerta daily, he was referred by his pediatrician for a comparison assessment. The older twin had been previously labeled as the more outgoing/hyperactive child; whereas the younger twin had been perceived as shy, developmentally delayed, and behaviorally less adventuresome. The older twin was also perceived as more competent and as having fewer learning problems. Results suggested that both boys were neuropsychologically compromised and in need of special educational assistance. Issues of emotional development were also of concern. Because the younger twin suffered from spina bifida and was more slight of stature, he tended to be more overprotected in his environment. Interventions, designed to assist each child to individuate and function more effectively, both socially and educationally, will be presented. The present data will also be used for baselines with interventions and follow-up assessments expected every one to three years.

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**J. MEYER, D. NEMETH, K. WALTERS, T. JENNINGS, J. HAMILTON, J. ARRINGTON, & K. GEIGER. Cognitive Profile Comparisons Between ASD and ADHD Children.**

Case comparisons based on three participants with high-functioning Autism Spectrum Disorders (ASD) and three participants with Attention Deficit Hyperactivity Disorder (ADHD) will be offered. ASD is characterized by a triad of impairments in communication, social reciprocity, and range of interests. ADHD, on the other hand, is characterized by inattention and/or hyperactive-impulsive behaviors that impair social, academic, or occupational functioning. A qualitative review of test scores revealed difficulties in knowledge of appropriate social behavior, motor planning, and visual motor integration among participants with ASD on test of cognitive abilities. For participants with ADHD, however, either difficulties were noted on tasks assessing freedom from distractibility or no difficulties were noted on any of the tasks. Behavioral and emotional differences will also be reviewed on the basis of parent, teacher, and self report measures. This presentation will highlight cognitive profiles which may be differentially associated with these two disorders.

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## NEURODEGENERATIVE DISORDERS AND DEMENTIA

**A. DANEK, L. SHEESLEY, M. TIERNEY, & J. GRAFMAN. Cognitive Findings in Patients With Chorea-Acanthocytosis.**

Chorea-Acanthocytosis (ChAc) is an autosomal-recessive degenerative disorder (MIM 200150) with hyperkinetic movements and prominent orofacial involvement (dysarthria, dysphagia, tics, lip and tongue biting). Red blood cell deformation (acanthocytosis), neuropathy and myopathy (areflexia, amyotrophy, CK elevation) are associated. The gene responsible, CHAC (chr. 9), appears relevant for intracellular protein sorting. ChAc offers an opportunity to study the consequences of "pure" striato-pallidal dysfunction since cortical involvement is absent or minimal on neuropathological examination. To better characterize the cognitive phenotype we studied eight patients (6 male, 2 female, 26–51 years old) with motor symptom onset at ages 20–34 (6–18 years before this investigation). In seven patients, CHAC mutations were identified. All patients showed an average general intelligence level (WAIS-III, mean full IQ 95) but with a moderate 5 to 24 point reduction in comparison to estimated premorbid values (NART). Selective deficits were found on Digit Symbol Coding and Symbol Search. Patients performed slightly below average on all subscales of the Wechsler Memory Scale (means: general memory 85, working memory 103). Verbal fluency was reduced in all patients. They showed mild impairment on Behavioral Assessment of the Dysexecutive Syndrome. Results on Wisconsin Card Sorting, the Stroop task and the Tower of London were heterogeneous. There was no aphasia, apraxia, neglect or perceptual disorder. In summary, this first prospective neuropsychological study of a fairly selective type of basal ganglia degeneration showed cognitive decline that progresses with disease duration. Memory was impaired in these patients with ChAc. Executive dysfunction showed individual-specific patterns.

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**A. ESTÉVEZ-GONZÁLEZ, C. GARCÍA-SÁNCHEZ, A. BOLTES, P. OTERMÍN, B. PASCUAL-SEDANO, A. GIRONELL, & J. KULISEVSKY. Early Decline for Recognition Memory in Alzheimer and Comparison With Mild Cognitive Impairment.**

Previous studies have documented poor recognition memory in patients with dementia of Alzheimer's type (DAT). In this study, we examined whether impairment in episodic recognition memory of pictures appears in the preclinical phase of DAT. Recognition task was administered as part of a more extensive neuropsychological battery at baseline evaluation in

unselected patients referred by subjective memory complaints (SMC). Seventy patients were followed longitudinally for 2 years (average interval of  $27.7 \pm 4$  months). Twenty-seven developed probable DAT; 17 were diagnosed as cognitively normal persons and 26 were diagnosed with Mild Cognitive Impairment (MCI). Performance on the recognition task at the baseline evaluation was compared between groups. The compared task was a recognition memory test which included photos of unknown buildings, landscapes and outdoor scenes. This task was adapted from Squire (1981) and Shimamura & Squire (1986). Group difference was analyzed with analysis of variance (ANOVA) using the age and sex as covariates, and Pearson correlation coefficient was used for correlations with functional scales. Patients who were diagnosed 2 years later with Alzheimer's disease performed significantly more poorly than MCI and Control groups ( $p < .0001$ ). Scores at the recognition memory task of pictures were combined with MMSE that had significant positive correlation ( $r = .423$ ;  $p < .001$ ) and with Blessed's Dementia Rating SCALE with significant negative correlation ( $r = -0.449$ ;  $p < .001$ ). We conclude that episodic recognition memory task of pictures could help to identify those patients with SMC who would progress to DAT over a few years.

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**C. JENNER, G. ORSITTO, & M.C. SILVERI. Neuropsychiatric Symptoms and Cognition in Frontotemporal Dementia.**

Changes in behaviour and personality constitute the core diagnostic features in frontotemporal dementia (FTD). The cognitive profile in FTD is not well specified. Neuropsychological studies comparing FTD patients with controls yielded inconsistent results. The heterogeneity of cognitive profiles in FTD may be due to disease characteristics as well as to methodological factors. The aim of this study was to investigate the relation between behavioural symptoms and cognitive impairment in FTD. 22 FTD patients were administered a wide range of neuropsychological tests. Informant based semi-structured interviews using the Neuropsychiatric Inventory Scale (NPI) were carried out to evaluate behavioural changes in FTD. Apathy, depression, agitation and disorders of eating behaviour were the most frequent behavioural symptoms. Statistical analysis revealed significant differences between patients and controls in a variety of cognitive tests. When FTD patients were separated in two groups on grounds of NPI-scores, patients with severe behavioural symptoms were more impaired than patients with mild behavioural symptoms only in the number of perseverative errors on the WCST. Performance in other frontal lobe tests was not related to the severity of neuropsychiatric symptoms. Moreover, severity of behavioural symptoms was not related to duration of disease or to MMSE scores. The lack of relation between impairments in frontal lobe tests and the severity of behavioural symptoms in FTD reflects the functionally highly differentiated structural organisation of the frontal lobes which can be selectively affected in FTD.

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**S. JÖRGENS, J. NICKEL, & R.J. SEITZ. Visual Neglect in Dementia: A Report of Three Cases.**

The prodromal loss of memory, orientation and speech are well known signs in the beginning of dementia of the Alzheimer type (AD). Additionally, in many cases visuospatial disturbances in early stages of the illness are described. But there are rarely reports about visual neglect in dementia. Here we report about three patients (age: 53–65), who showed relatively mild dementia (MMSE: 25–27), with no disorientation, no aphasia, no apraxia and relatively mild memory problems, but in contrast signs of severely abnormal visual functions. All three patients presented with problems in visual exploration and visuoperception/-construction. Additionally they showed visual hemineglect to the left. In a patient who was studied sequentially, the first signs consisted of visual disturbances, left sided exploration problems and an extinction phenomenon in the visual modality. However there were no defaults in cancellation tasks except for



an inverted direction of exploration from the right to the left side. On retest after one year the patient showed a complete visual neglect. FDG-PET, carried out in two patients, showed an asymmetric right temporoparietal hypometabolism, which affected additionally the parietal cortex and the primary visual cortex. MRI-scans revealed no atrophy. We conclude that the clinical feature described above may represent an atypical form of AD.

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**N. RIEFFEL & A.M. BERARDI. Effects of Depression on Executive Functions in Dementia of the Alzheimer Type.**

It is unknown to what extent depression further affects executive functions in patients with mild to moderate Dementia of the Alzheimer Type (DAT). We compared 12 depressed DAT patients (9 women, 3 men) scoring above 4 on the short version of the Beck Depression Inventory (BDI) and 13 nondepressed patients (11 women, 2 men) scoring below 4 on the short BDI. The two groups were matched on dementia severity (Mini Mental Status Examination: 21f3 vs. 21t4 for depressed vs. nondepressed DAT,  $F < 1$ ), age ( $F < 1$ ) and education ( $p = .23$ ). Three aspects of executive functions were evaluated: concept formation using Raven's Colored Progressive Matrices, planning ability using the Porteus Mazes, and cognitive flexibility using the Stroop Color-Word Test. Results were analyzed using ANOVAs with one between-group factor (depressed vs. nondepressed DAT) and one within-group factor (the score on each test). Depressed DAT patients had lower scores than nondepressed DAT patients on concept formation (Raven's total:  $p = .008$ ; Raven Part A:  $p = .03$ ; Raven's Part AB:  $p = .06$ ; Raven's Part B:  $p = .16$ ) and planning ability ( $p = .06$ ). Depressed and nondepressed DAT patients did not differ on cognitive flexibility (Stroop Part1,  $F < 1$ ; Stroop Part2:  $p = .32$ ; Stroop Part3:  $F < 1$ ). These results suggest that depression affects concept formation and planning but not cognitive flexibility. Hence, at least for selected cognitive functions, depression may add further impairment to that usually observed as a consequence of DAT.

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**K.H. RYU, Y. KANG, J.S. PARK, J.H. CHIN, D.L. NA, & J.H. LEE. Topographical Disorientation and Neuropsychological Functions in Dementia Patients.**

Topographical disorientation (TD) refers to an impairment of spatial orientation and navigation in the real-world environment. The present study was conducted to examine the prevalence of TD in dementia patients and to find the relationship between TD and neuropsychological functions. The participants were 86 patients with probable Alzheimer's disease (AD; mean age  $72.10 \pm 7.66$ ) and 58 patients with vascular dementia (VaD; mean age  $71.02 \pm 8.72$ ). There were no group differences in age, educational level, and dementia severity assessed by MMSE and CDR. The existence of TD was assessed by the family members' report about the patient's way-finding difficulty. A comprehensive neuropsychological evaluation (Seoul Neuropsychological Screening Battery) was given to the patients. There was no difference between AD (58%) and VaD (52%) in the prevalence of TD reported by their family members. This result indicates that TD is common in VaD as well as in AD. With regard to the neuropsychological functions, the dementia patients with TD, overall, showed lower performance on visuospatial function, visual memory, and frontal/executive functions than those without TD, which is consistent with the previous review (Barrash, 1998). However, when the AD and the VaD were examined separately, the same pattern was found in VaD, whereas AD with TD showed poorer performance only on the frontal/executive functions than AD without TD. These findings suggest that TD is not unique to AD and AD with TD is more progressed in the severity of disease than AD without TD.

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**E.J.A. SCHERDER & L. EGGERMONT. Cognitive Functioning and Pain Experience in Patients With Vascular Dementia.**

In previous studies, patients with Alzheimer's disease (AD) were reported to experience less pain intensity and pain affect than elderly without dementia. There are some indications, however, that patients with vascular dementia (VaD) experience an increase in pain. Therefore, a first goal of the present study was to examine whether VaD patients ( $n = 6$ ) indicate to perceive more pain from their painful conditions than nondemented elderly ( $n = 6$ ). Certain brain areas, e.g., the hippocampus and anterior cingulate cortex, play a crucial role in both cognition (e.g., memory and attention, respectively) and the processing of painful stimuli. Consequently, the second goal of this study was to examine possible relationships between the performance on various neuropsychological tests (and hence the functioning of related brain areas) and the extent of suffering from pain. An extensive neuropsychological test battery was used to assess cognitive functioning. Pain assessment took place by administering various visual analogue scales and one observation scale. Preliminary results show that, compared to nondemented elderly, patients with probable VaD indicate to experience significantly more pain. Furthermore, only in the group without dementia a significant positive correlation was found between pain and tests appealing to the medial temporal lobe, i.e., the better the performance on various memory tasks, the more the subjects suffered from their pain. It is concluded that a larger group of patients should be included before firm conclusions can be drawn.

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**Y.A. SCHREIBER, N. ACKL, M. ISIN, & A. SONNTAG. Is the CERAD Battery Suitable to Differentiate AD, VD, and Mixed Dementia?**

**Objective:** The differential diagnosis of Alzheimer's dementia (AD), vascular dementia (VD) and mixed dementia (Alzheimer's and vascular dementia) is difficult using only clinical information. The purpose of this study was to compare the cognitive performance of these different diagnostic groups using the CERAD neuropsychological battery (CERAD-NP) and to search for distinct neuropsychological markers. **Method:** All patients were recruited from the memory clinic of the MPI and diagnosed according to DSM-IV, NINCDS-ADRDA, NINDS-AIREN criteria, and ADDTC guidelines. The cognitive performance in the CERAD-NP of 47 patients with AD ( $72 \pm 9$  y, m/f : 29/18, education:  $10 \pm 2$  y), 16 VD patients ( $73 \pm 8$  y, m/f : 7/9, education:  $9 \pm 2$  y) and 19 patients with mixed dementia ( $75 \pm 7$  y, m/f : 10/9, education:  $9 \pm 2$  y) was compared. **Results:** According to a multivariate analysis there were no significant differences among the diagnostic groups concerning age, gender, education, and MMSE. No subtest of the CERAD-NP could significantly discriminate between the three groups, although there were slightly different performances in a few subtests. **Discussion and conclusion:** It was not possible to differentiate between the dementia groups described above using the CERAD-NP. A correlation with further diagnostic tools like MR-tomography and -spectroscopy as well as CSF- and blood-analysis is of interest in order to search for associations between the CERAD-subtests and biological markers of dementia.

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**D. YEO, P. MARUFF, M.M. SALING, A. COLLIE, & D. DARBY. Testing Cognition With Playing Cards.**

**Background:** Neuropsychologists are increasingly required to assess cognition in individuals whose cultural and linguistic backgrounds are dissimilar to their own. **Aim:** To develop a framework, with minimal cultural and language requirements, for the cognitive assessment of older people. Playing cards are familiar to individuals from a wide variety of cultural backgrounds, and we based a series of cognitive paradigms on a pack of standard playing cards. **Method:** Forty healthy volunteers (mean age of 67.9), and eleven patients (mean age of 70.8) with possible cognitive impairment, participated in our study. We constructed a Playing-Card Battery (PCB) of

tests measuring reaction time (RT) involving card-sorting by colour, suit, and number; working memory (WM) based on Petrides' (1988) self-ordered pointing task; recognition memory (RM) analogous to Moss et al's (1986) recognition span test; and paired associate learning (PA) similar to Lhermitte and Signoret's (1972) spatial memory task. MMSE, CANTAB-PAL, CERAD word list recall, and WAIS-R were also administered. *Results:* Correlational analyses indicated good construct validity for each playing-card test. There were significant relationships ( $r = .415, p = .009$ ) between the memory measures (RM, PA) and they did not correlate with working memory (WM) or psychomotor speed (RT) performance. The PCB identified aspects of cognitive impairment in the clinical sample that were consistent with the patients' neurological diagnoses. *Conclusion:* The PCB has good construct and discriminant validity, and sensitivity to cognitive deficits associated with Alzheimer's disease and mild cognitive impairment. These preliminary findings provide a useful framework to further examine cross-cultural applications of the PCB.

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## NEUROPSYCHOLOGY OF EMOTION

### G. KUHN & A.M. BERARDI. Preference and Temporal Estimation of Visual and Auditory Emotional Sequences.

The effects of preference on temporal estimation of visual and auditory sequences of different emotional valence is unknown. Sixteen University students (8 males, 8 females) with a mean age of 22 to 2.31 (SD) were administered 4 visual (film clips) and 4 auditory (music) sequences of different emotional valence (anxiety provoking, horror inducing, relaxing, and comic) in counterbalanced order. All sequences lasted 2 min. 53 sec. The emotional valence of each sequence was validated objectively using subject's ratings. After each sequence, subjects rated on a 1–4 point scale their degree of preference and estimated the time each sequence had lasted. Two temporal estimations were required: 1) objective temporal estimation (how long did each sequence last, expressed in minutes and seconds), and 2) subjective temporal estimation (how short or long each sequence felt, marked on a 60 mm visual analogue). Pearson correlations indicated that preference was negatively correlated with subjective temporal estimation for horror ( $r = -.55, p < .05$ ) and relaxing film clips ( $r = -.60, p < .05$ ) and for horror ( $r = -.47, p < .10$ ) and relaxing music sequences ( $r = -.50, p < .05$ ), but not for comic or anxiety provoking sequences in either modality. Preference did not correlate with objective temporal estimation for none of the sequences in either modality (all  $p > .10$ ). Hence, preferred sequences are judged to be the shortest, whereas non preferred sequences are judged to be the longest. Results were consistent across visual (simultaneous processing) and auditory (sequential processing) modalities, and suggest that subjective temporal estimation is affected by emotion.

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### A.S. OLAYIWOLA. Ethological Comparative Analysis of Attack, Defense Among Higher Brains Animals.

Neural circuitry of attack and defense involve the forebrain and midbrain. The forebrain pathways process motivating stimuli in the septum and amygdala and convey these influences to the hypothalamus, and then relay them backwards to motivational mechanisms in the midbrain. The motivational mechanisms with known locations are in the central gray of the midbrain. Starting from the central gray, descending projections spread out to form motor patterning mechanisms lie in the midbrain and hind-brain. Many ethological studies have been carried out among different species of higher brain animals including cats, rats and primates. All the same, it is significant to compare and evaluate available neuronal information among the animal species. This is because such ethological assessment would give detail information on brain mechanisms. On the whole, it

is important to note that there are many similarities than differences among these animals, which warrants comparative assessment. This paper gives a detail comparative analysis of attack and defensive behaviours among vertebrates based on available data.

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### C.C.Y. CHEUNG. Cognition of Emotion Recognition.

The research was intended to explore the cognitive processes involved during the recognition of basic emotion expressions. The ways that different facial expressions are represented were explored. A total of 40 participants were involved in the current study. We put forward the hypothesis proposed by Rhodes et al. (1993) on ordinary face recognition for the discussion on facial emotion recognition in the current study, suggesting that both the perception of individual features and the configural information contribute to facial emotion recognition. The facial features of each of the expressions of basic emotions were manipulated according to the three conditions. In Condition 1, only the individual features of faces were presented, which aimed at examining whether the expressions can be perceived without the assistance of the configural information. In Condition 2, the 1st order configural information was disrupted. In Condition 3, the changes in the 2nd order configural information were included. The hypothesis was supported by our findings that the expressions involving configural information were better recognized than those without configural information. Besides, the facial features also contributed in different degrees to the recognition of expressions of different emotions. It was noted that holistic processing of facial expressions was important to our quick and accurate recognition of facial expression. Furthermore, holistic process may also be the necessary requirement for the accurate recognition for the expressions of sadness, disgust and fear.

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Symposium 5/1:00–2:30 p.m.

## MEMORY, HIPPOCAMPUS, AND BRAIN METABOLISM/PERFUSION— DIFFERENT FACETS OF THE SAME COIN?

Chair: Michael Kopelman

Organizers: Michael Kopelman and Jonathan Foster

Discussant: Michael Kopelman

### M.D. KOPELMAN & J. FOSTER. Memory, Hippocampus, and Brain Metabolism/Perfusion—Different Facets of the Same Coin?

The role of the hippocampus in human memory continues to be a matter of great controversy. Functional neuroimaging studies (PET, fMRI) find activations during learning that are prominent in the frontal lobes as well as medial temporal structures. The relationship of these structures and their respective putative roles during learning remain matters of controversy. Dr Paul Fletcher will review current theories in the light of neuroimaging findings. There are also controversies about the role of the hippocampi in anterograde and retrograde memory—whether recognition memory is affected as well as recall memory, and the extent of retrograde memory loss following focal hippocampal lesions—the latter controversy relating to the traditional consolidation *versus* the multiple trace model of memory. Dr Jonathan Foster will be presenting a case which highlights these issues. Semantic dementia has been postulated by Graham and Hodges (1997) and others as providing a contrasting pattern of structural damage within the temporal lobes, in which hippocampal functioning is said to be relatively spared: Dr Helen Moss will present findings from a study of the autobiographical memory of a semantic dementia patient which relates to these issues. Finally, the hippocampi are particularly sensitive to hypoxic, ischaemic, and hypoglycaemic brain damage. Dr Sandra Sünram-Lea will

review biochemistry of memory, and report studies which have investigated whether the administration of glucose can significantly facilitate memory processes in healthy individuals.

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#### **J. FOSTER. Studying a Selective Case of Hippocampal Amnesia.**

Ever since the report of patient H.M. in the 1950s, there has been intensive interest in reports of cases of hippocampal brain damage. More recently, there has been further controversy surrounding the involvement of the hippocampus in recall *versus* recognition memory, with different researchers adopting markedly contrasting positions on this important question. We have been studying a patient in Australia who presented with anterograde amnesia subsequent to an apparent period of loss of consciousness and hypoglycaemia. This individual has sustained apparently specific bilateral injury to the brain, which is focused on the medial temporal lobe. We here report the findings from investigations of this individual, which have examined his anterograde and retrograde memory status, his learning of supraspan lists, his language capacity and his performance on tests of recall and recognition. These findings significantly inform our knowledge of memory and the brain, specifically regarding the role of the hippocampus and nearby brain structures in different aspects of anterograde and retrograde memory functioning.

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#### **P.C. FLETCHER. Fronto-Hippocampal Patterns of Activity in Human Memory—A Neuroimaging Perspective.**

Functional neuroimaging offers opportunities to complement, expand upon and refine, insights delivered by neuropsychological studies of human memory. Key strengths of imaging techniques, with regard to memory research, include the capacity to perform separate assessments of encoding and retrieval stages, to characterise time-dependent changes associated with learning and to evaluate functional relationships between critical brain regions, particularly frontal and medial temporal cortices. While early functional neuroimaging studies using positron emission tomography produced strong evidence for frontal involvement in both encoding and retrieval, measurements of hippocampal function have been rather less consistent. However, the increased temporal resolution and experimental flexibility associated with functional magnetic resonance imaging have offered a richer, though highly complex, picture of frontal and medial temporal roles. Particular interest has focussed upon the extent to which activity in these regions, measured at encoding, predicts subsequent item and association retrieval. The nature of this predictive relationship will be reviewed in the presentation together with ways in which it is complementary to insights arising from lesion studies.

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#### **H.E. MOSS, M.D. KOPELMAN, M. CAPPELLETTI, P. DE MORNAY-DAVIES, & E. JALDOW. Lost for Words or Loss of Memories?—The Hippocampi and Autobiographical Memory in Semantic Dementia.**

Recent reports have suggested that patients with semantic dementia show a loss of early autobiographical memories with pronounced sparing of recent memories, and this has been related to their extensive temporal lobe damage with relative sparing of the hippocampi. It has been suggested that the hippocampal complex plays a time-limited role in the acquisition and storage of memories, while the temporal neocortex is required for long-term storage and retrieval. This, in turn, suggests that the deficits in semantic dementia go beyond the semantic domain. We postulated that previous studies may have underestimated the more purely semantic task demands in autobiographical memory tests. We used a cued autobiographical memory interview in a semantic dementia patient, finding that the

provision of specific cues enabled him to access and express remote as well as recent autobiographical memories. There was a gentle recency effect, but only for intermediate levels of cueing. Our findings are consistent with the view that the deficits in semantic dementia are predominantly or exclusively semantic, rather than involving the storage of autobiographical memories *per se*.

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#### **S. SÜNNAM-LEA & J. FOSTER. Can Administration of Glucose Facilitate Memory Processes?**

The brain has a very high rate of energy consumption relative to its size, and requires a ready supply of 'fuel'. Glucose is the major fuel for the brain, and the continuous delivery of glucose via the bloodstream is essential for the normal functioning of the central nervous system. The relationship between normal brain functioning and glucose has been well established for many years. However, it was not until relatively recently that systematic investigations into the cognitive effects of variations in blood glucose levels were begun. Over the past decade, it has been clearly demonstrated that changes in blood glucose levels can affect memory processes. We here present some of our studies that have investigated whether the administration of glucose (and its primary biochemical reagent—oxygen) can significantly facilitate memory processes in healthy, young individuals. The implications of our findings for the cognitive neuroscience of memory will also be considered.

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**Symposium 6/1:00–2:30 p.m.**

#### **DICHOTIC LISTENING IN STUDIES OF BRAIN LATERALITY AND ATTENTION**

**Organizer and Chair: Kenneth Hugdahl**

#### **K. HUGDAHL. Dichotic Listening in Studies of Brain Laterality and Attention.**

Dichotic listening is one of the classic behavioral techniques to study brain lateralization and hemispheric asymmetry. Introduced to Neuropsychology in the early 1960s by Doreen Kimura, this relatively simple technique has resulted in hundreds if not thousands of research reports over the years. Dichotic listening still attracts interest among researchers in brain laterality and language processing. An extension of the classic neuro-anatomical model to explain the right ear advantage in dichotic listening has also focused on the role of attention and executive functions. Thus, dichotic listening is today used in both research and clinical practice in Neuropsychology related to such key areas as language, attention, memory, and executive functions. In this symposium the use of dichotic listening in Neuropsychology will be illustrated from both basic and clinical research. K. Hugdahl will present his work on how attention/executive dysfunctions in psychiatric and neurological disorders may be studied with dichotic listening. Stephan Pollmann will present recent data on language processing in the left and right hemispheres in patients with callosal lesions, including questions related to right hemisphere language. Lutz Jäncke will present data from fMRI studies of dichotic listening, showing localization of brain activation networks during dichotic stimulation as a function of stimulus type and attention instructions. Marien Gadea has applied dichotic listening and functional neuroimaging in MS patients, looking at relationships with corpus callosum size.

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### K. HUGDAHL, B. RUND, & A. LUND. Dichotic Listening in Schizophrenia.

In this study 51 schizophrenic, 49 depressed, and 49 healthy control subjects were compared with regard to their performance on the dichotic listening task. A variant of the traditional dichotic listening paradigm was used where the subjects were required to focus attention either on the left (forced-left condition) or right (forced-right condition) ear stimulus. We predicted that if schizophrenic and depressed patients were impaired on cognitive functions related to attention they should have problems modulating their scores in the forced-attention conditions. If they in addition had a sensory processing deficit, they would also be impaired in the non-forced condition. The patients all had a DSM-IV diagnosis of schizophrenia or recurrent unipolar major depression. There was a significant overall right ear advantage during the non-forced condition, which increased dramatically during the forced-right condition, and was eliminated during the forced-left condition. The depressed patients showed no signs of impairments compared to the healthy control group. Thus, they showed a right ear advantage during the non-forced and forced-right conditions, which was shifted to a left ear advantage during the forced left condition. The schizophrenic patients, however, were impaired on the forced-left condition compared to the healthy control and depressed subjects. The results are discussed in terms of separating attentional and inhibitory executive impairments in schizophrenia and depression, taking illness duration and information processing demands into consideration.

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### S. POLLMANN, M. MAERTENS, J. LEPSIEN, K. HUGDAHL, & D.Y. von CRAMON. Parallel Auditory and Visual Target Detection Deficits After Splenial Lesions.

Partial lesions of the corpus callosum may lead to left ear suppression in consonant-vowel dichotic listening tasks. Initially, lesions of the posterior part of the trunk of the corpus callosum were thought to be associated with left ear suppression. In the monkey, this area contains auditory commissures. Consequently, disruption of auditory transfer to the language-dominant hemisphere was thought to be the cause for the left ear suppression. However, we and others found partial callosal lesions in the splenium to be associated with left ear suppression. These lesions were more posterior than the putative location of the callosal fibers between human auditory cortices, suggesting that no transfer of auditory signals was interrupted by splenial lesions, but transfer of amodal attentional signals. This hypothesis was confirmed in a second patient study, in which patients with partial lesions of the splenium showed higher costs of invalid peripheral visuospatial cues than patients with pre-splenial partial lesions of the corpus callosum. Invalid visuospatial cues and dichotic listening have in common that the target has to be detected in the presence of competing stimuli in contralateral space. The splenium contains transcallosal fibers from the temporo-parietal junction area, a region known to be involved in target detection at unattended locations. We therefore conclude that the left ear suppression in dichotic listening and the increased costs of invalid visuospatial cues observed after splenial lesions are due to the interruption of supramodal target-alerting signals, possibly originating in the temporo-parietal junction area.

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### L. JÄNCKE. The Neural System of Dichotic Listening Studied With fMRI.

Dichotic listening (DL) is a widely used experimental paradigm in which subjects listen to two different auditory stimuli at the same time, one in each ear, under divided attention and sometimes under forced attention conditions. The typical finding for verbal stimuli (phonological or language stimuli) is a superior report of the right compared to the left ear items, a finding which is called a right ear advantage (REA). The opposite effect, that is, a left ear advantage (LEA) has been obtained for dichotically presented non-verbal stimuli, e.g., melodies, tonal sequences, or

emotional stimuli. Several models have been suggested to explain these ear-advantage effects comprising the structural and the attentional model. However, until now there is no consensus which of these models is sufficient to explain dichotic listening performance. In order to understand the neural structures involved in dichotic listening, we conducted three independent dichotic listening experiments in which stimulus type (phonetic, emotional, and tonal information) and attentional conditions (forced right and left, divided attention) were varied. In general it was found that bilateral neuronal networks comprising parietal, temporal and frontal brain areas were active during all conditions. However, directing attention to one ear while neglecting information presented to the other ear had strong effects on the activation pattern within this network independent of stimulus type. A subsequently performed path-analysis uncovered that the effective connectivity within this network changed as a function of attentional condition. Thus, it might be that directing attention is the main factor explaining the activation pattern within this network and the accompanying dichotic listening performance.

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### M. GADEA, R. ESPERT, L. MARTÍ-BONMATÍ, B. CELDA, & B. CASANOVA. Dichotic Listening and Neuroimaging in Early Relapsing-Remitting Multiple Sclerosis.

In 25 relapsing-remitting multiple sclerosis (RR MS) patients with minimal disability, nonforced (NF) *versus* forced attentional (FA) dichotic listening (DL) performance was related to different brain areas. The laterality index obtained for NF DL correlated inversely with the splenium of the corpus callosum (CC) in men and the isthmus in women measured in midsagittal MRI. The attentional index obtained for FA DL was not related with CC measures. Repeated assessment after one year showed stronger correlation and, in addition, a worsening in NF DL performance and reduced CC measures. On the other hand, IH-MRS (spectroscopy), measured at the pontine nuclei of the reticular system, showed decreased N-Acetyl-Aspartate (NAA) which correlated inversely with the attentional index but not with the laterality index obtained in DL. A stepwise regression showed that the relation was due mainly to NAA levels obtained at right pontine nuclei. Our results indicated that: 1) In early MS laterality and attentional dysfunction can be observed through DL. 2) When linking the behavioural results to CC measures the data suggested a more anterior crossing for the auditory channel for women than for men. 3) Spectroscopy data showed the connection between white matter alteration at right pons and selective attention, adding new data to link this cognitive function to the right hemisphere. The data as a whole are discussed in terms of the "dual model" of DL, that posits a bottom-up *versus* top-down processing, related to laterality *versus* attentional functions, and reflected in NF *versus* FA DL respectively.

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## Paper Session 5/1:00–2:30 p.m.

### INTERNATIONAL CLASSIFICATION OF FUNCTIONING

### S. GEYH, A. CIEZA, S. CHATTERJI, M. FÜSSL, T. EWERT, & G. STUCKI. How to Apply the ICF in Neurological-Neuropsychological Rehabilitation.

During the last few years, the WHO "biopsychosocial" model of functioning and disability has become an essential framework for rehabilitation and has also attracted much attention in the field of neurorehabilitation. The International Classification of Functioning, Disability and Health (ICF) based on this model was approved by the World Health Assembly in 2001. The ICF enables to describe and classify functioning and health in internationally-accepted terminology. While the ICF provides a universal

framework, it must be adapted for application in clinical practice, assessment, and research. Therefore, scientifically-based, condition-specific ICF Core Sets are being developed in a collaborative project at the University of Munich with the WHO. ICF Core Sets for stroke patients are also being developed. Within this context, ICF Core Sets are short lists of ICF domains relevant to most stroke patients. The spectrum of prototypical domains is derived from preliminary studies using empiric data, Delphi surveys, and systematic reviews. The suggested domains are presented to a panel of international experts. A decision-making and consensus process based on the results of the preliminary studies takes place during the consensus conference to define the ICF Core Sets for stroke. In a further step, the ICF Core Sets for stroke will be tested in a multi-center cohort study. The ICF Core Sets for stroke can be used in neurological-neuropsychological rehabilitation to meet the emerging need for multi-level assessment considering not only isolated senso-motoric and cognitive deficits but also including everyday activities, participation as well as patients' social and physical environment.

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#### **M. GROGAN, S. BARKER-COLLO, & D. MCCARTHY. Predicting Functional Outcome Post-Stroke and Post-TBI.**

An increasing emphasis has been placed on the measurement and prediction of post-stroke and post-TBI outcomes in recent years. This increased focus has been the result of increased pressure on rehabilitation services to be effective in terms of maximising recovery and discharge planning. Early assessment is clinically important because it provides early identification of deficits, and can direct appropriate early intensive intervention. In terms of research a profile of predicted functioning can be gained for both stroke and TBI. The present study used a screening assessment which included cognitive, emotional and physical aspects to provide early identification of deficits. The physical measure used was the Functional Independence Measure (FIM). Cognitive assessments included verbal and visual memory tests, measures of auditory and visual attention and information processing. The Beck Depression and Beck Anxiety Inventories were used to screen for emotional functioning. The study used a longitudinal design where each person was assessed at intake to a rehabilitation centre, then again at three months and six months post-stroke/post-TBI. Outcome at six months was assessed using a health related quality of life instrument and other self-report measures. Preliminary results indicate that anxiety score and Stroop colour-word at Time 1 strongly correlate with outcome at six months. Depression at three months (Time 2) also contributed to the prediction of outcome. Further results and their implications for rehabilitation in New Zealand will be discussed.

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#### **B.O. HÜTTER, C. KARLOWSKY, M. BRÜGMANN, & J.M. GILSBACH. The Relationship Between Subjective Complaints and Cognitive Impairments.**

The assessment of quality of life (QOL) in brain-damaged patients becomes increasingly important in clinical research and practice. However, not much is known about the relationship between measures of QOL and cognitive impairments. A series of 87 patients with an age mean of 37.8 years (25 females and 62 males) were studied one to two years after head injury by means of the Aachen Life Quality Inventory (ALQI) and neuropsychological tests including attention, figural and verbal short- and long-term memory, aphasia, concentration and spatial cognition. 13% of the patients had sustained a severe, 28% a moderate and 59% a mild head injury. Proxy-ratings could be obtained of 71 life partners of the patients. In the case of self-rated QOL, the statistically significant correlations were modest and ranged between  $r = .26$  ( $p < .01$ ) and  $r = .46$  ( $p < .001$ ). Functions of attention and memory had the closest relationship to QOL. The associations between the neuropsychological test performance and

QOL as rated by the proxies were consistently weaker. Analyses of variance showed significant ( $p < .05$ , respectively) effects of the degree of neuropsychological impairment. Multivariate analyses revealed figural short- and long-term memory and simple reaction time as the most important predictors of the overall QOL sharing 27% of common variance while the psychosocial aspect of QOL was explained by figural long- and verbal short-term memory performance and cognitive speed sharing 24% of common variance. The associations between QOL and the neuropsychological test performance are at best modest. The determinants of this relationship should be explored in further studies.

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#### **N. KELLER-HAHN, M. KELLER, J. KOOL, & J. KESSELRING. Validation of an Assessment for Extended ADL in Neurological Patients.**

**Introduction:** A primary goal of rehabilitation is to improve the patient's activities of daily living (ADL). Enhanced performance in neuropsychological tests after neuropsychological rehabilitation does not automatically imply an ADL gain. Therefore an assessment to evaluate the performance in extended ADL with increased neuropsychological demands, the VAT-Test, was developed consisting of 10 tasks such as using a parking automat or reading a bus timetable. Performance is rated in a standardized manner and time is recorded. The purpose of this study was to investigate practicability, validity and reliability of the VAT-Test. **Methods:** Included were patients without prior morbidity who suffered their first stroke, and healthy controls. To assess the validity of the VAT-Test the Spearman correlation with the Extended Barthel Index (EBI, score 17–68) was determined and Cronbach Alpha was used to investigate the Reliability. Correlations with neuropsychological tests were analysed. **Results:** We studied 14 patients aged 59 years ( $SD = 14$ ) with a stroke 4.4 month previously and a mean EBI 44.7 ( $SD = 14.7$ ), and healthy controls aged 58 years ( $SD = 5$ ). All participants completed the VAT-Test. The correlation between the total score on the VAT-Test and the EBI was moderate (.58) and significant ( $p = .029$ ). The reliability was good (Cronbach Alpha = .87). Patients needed significantly more time than controls in 4 out of 5 timed tasks. The patients' performance on neuropsychological tests was impaired due to multiple deficits. There was no significant correlations between the VAT-Test and neuropsychological tests. **Conclusion:** The VAT-Test is practicable, valid and reliable measure of EADL.

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#### **J. MALEC. Objectively Measured Personality and Outcome After TBI.**

Research examining objectively measured personality and outcome of traumatic brain injury (TBI) is very limited. Our previous research showed only Depression among scales of the NEO Personality Inventory-Revised (NEOPI-R) predicted staff assessment of independent living and work after TBI. The current study included a measure of global outcome reported by patients with TBI and significant others (SO). **Subjects:** 54 patients with moderate-severe TBI (GCS < 13 or abnormal CT scan) and SO. **Measures:** Post-traumatic amnesia (PTA); NEOPI-R personality inventory, Rasch-scaled Participation and Independence Measure (PIM), and Rasch-scaled Mayo-Portland Adaptability Inventory (MPAI) completed by patients and SO. **Method:** Within 90 days of discharge from hospitalization after TBI, patients and SO completed NEOPI-R versions to describe pre-injury personality of the patient and outcome measures of independent living and work (PIM) and of more general cognitive, behavioral, emotional, and social outcome (MPAI). **Results:** Multiple regression analyses found PTA accounted for 16–18% of variance on SO MPAI ( $p < .005$ ); Hostility on the SO NEOPI-R accounted for an additional 17% ( $p < .001$ ) and Vulnerability on Patient NEOPI-R, an additional 7% ( $p < .05$ ). PTA accounted for 3–13% of variance on Patient MPAI; Depression on SO NEOPI-R added 15% ( $p < .005$ ), Vulnerability on Patient NEOPI-R, added 10% ( $p < .02$ ). NEOPI-R did not predict PIM. **Conclu-**

sions: Facets of Neuroticism vulnerability, hostility, depression may contribute to more global adjustment after TBI. Personality factors do not predict self- or family-evaluation of independent living and work status. The direction of causality is uncertain, however, and aspects of Neuroticism may also represent or result from poorer psychological and social adjustment.

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#### **U. SATISH, S. STREUFERT, R. BROWN, & S. VANDER VOORT. SMS Simulations: Capturing Dysfunctions in Response to Real-World Challenges.**

*Introduction:* Several neuropsychological tests provide excellent information about specific cognitive dysfunctions. However, measuring a person's overall effectiveness in response to multiple, interactive challenges of today's complex world requires a technique that (1) measures responsiveness to multiple interrelated demands and (2) provides reliable and validated data on several relevant indicators of day-to-day (real-world) functioning. This paper discusses such measurement via a unique methodology. The Strategic Management Simulation (SMS) captures multiple higher order decision-making/action competencies. Data on a range of dysfunctions (traumatic brain injury, chronic fatigue syndrome, early schizophrenia, generalized anxiety disorder and major depression) indicate shortcomings that are unique to each morbidity and identify individual differences among patients. *Method:* Highly reliable SMS simulations have been validated across cultures and continents for more than 40 years. Three hours of participation provides 25 independent computer calculated indicators of effectiveness that include relatively simple (e.g., activity levels), intermediate (e.g., information search and utilization) and highly complex (e.g., planning and strategy) aspects of functioning. *Conclusion:* The SMS measures real world effectiveness. Detailed feedback is available to patients, physicians and insurers. Data are also used to counsel patients about their areas of vocational strength.

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### **Paper Session 6/1:00–2:30 p.m.**

#### **NEUROPSYCHOLOGY I**

#### **J. ANDERSON & M.M. SALING. Deficits in Information Processing Following Lacunar Infarction.**

Researchers have traditionally argued that individuals show no cognitive change after lacunar infarction. Nevertheless, patients who have suffered a lacunar infarction often complain of subtle cognitive difficulties post-stroke, and it has been suggested recently that these patients may experience high level 'mental capacity' difficulties, which are not assessed with traditional clinical neuropsychological tools. The aim of this study was to re-examine the question of cognitive impairment in patients with lacunar infarct using two computer-based information-processing paradigms. Community-based samples of 18 first-ever lacunar infarction patients as well as 13 control participants were recruited through the North Eastern Melbourne Stroke Incidence Study (NEMESIS). Rate of information processing and capacity to process dual tasks was investigated. Stroke participants were significantly slower than controls in processing information when the number of distractor stimuli increased beyond five ( $p = .030$ ). In addition, stroke participants demonstrated significantly reduced ability to process two tasks simultaneously ( $p = .041$ ). The implications of these findings will be discussed.

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#### **M. PREISS, V. BENES, J. KOBLIHOVA, & J. KLOSE. Cognitive Deficits and Personality After Subarachnoid Hemorrhage—1 Year Follow-Up.**

Management of patients with aneurysmal subarachnoid hemorrhage (AN SAH), treatment of consecutive vasospasms and hydrocephalus is still one of the most frequently discussed issues in the neurosurgical literature. Recently the rapid advancement of endovascular techniques can be seen. Endovascular approach is becoming routine and AN treatment is slowly shifted from the hands of neurosurgeons to the hands of interventional radiologists. 41 patients after SAH were assessed 1 year after the intervention and divided in "clipping" and "coiling" subgroups. Neurosurgical variables e.g., Fischer Grade (CT), timing of intervention, AN localisation, periinterventional complications, consecutive vasospasms (TCD, angiography), hydrocephalus (CT, lumbar infusion test, isotope cisternography) and neurological picture were considered. All patients were assessed by a battery of neuropsychological and personality tests, which include WAIS-III, Auditory Verbal Learning test (AVLT), Temperament and Character Inventory (TCI), Beck Depression Inventory (BDI), Trail Making Test (TMT), SQALA and some other tests. The results are discussed in term of type of intervention. Supported by IGA MZ CR NF 6800-3.

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#### **A. SHUTTLEWORTH-EDWARDS, C. GIAI-COLETTI, I. REID, M. BORDER, & S. RADLOFF. The Cumulative Effects of Mild Head Injuries in Senior School Players of Rugby Union.**

The aim of this study was to investigate the neuropsychological effects of cumulative mild head injuries sustained in schoolboy Rugby Union. Participants were top team rugby players ( $n = 79$ ) and field hockey player controls ( $n = 58$ ) from three South African boys high schools. Previously reported mild head injuries were significantly greater for rugby players compared with hockey players (mean = 2.29 and .35, respectively). There was no significant difference between rugby and controls for estimated IQ (derived from the WAIS-III Vocabulary and Picture Completion subtests). Players with a prior history of neurological or learning disorder, substance abuse, moderate to severe head injury, or those in a recovery phase following a mild head injury, were excluded from the study. Group mean comparisons across a battery of neuropsychological tests administered early in the season revealed impaired performance amongst rugby players relative to controls on two tests of visuo-perceptual tracking, viz. Digit Symbol Substitution and Trail making Test (Part A). There were no significant differences for rugby Forwards versus rugby Backs. The finding of deficit for rugby players on the prototypically sensitive Digit Symbol Substitution test, replicates prior research on professional rugby players. Unlike previous research on professional players, Forwards did not reveal impairment relative to Backline players. Given the limitations of cross-sectional research, the study provides tentative support for the deleterious effects of cumulative mild head injury in association with participation in Rugby Union amongst top-level high school boys.

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#### **K.J. TOWGOOD, J.A. OGDEN, & E.W. MEE. Neuropsychological Outcome of Treatment for Unruptured Intracranial Aneurysms.**

Most recent figures on unruptured intracranial aneurysms (UIAs) in the general population estimate the prevalence to range between 1–2%. The effect of a UIA rupturing is potentially devastating, with estimates that approximately 50% of rupture cases result in death or long term disability. With rupture producing such disastrous consequences it would appear sensible to treat these aneurysms before they rupture. But in considering this question it should be pointed out that almost all aneurysms never rupture. The primary question then becomes one of weighing the risks and benefits of treatment. Extensive morbidity and mortality studies have suggested that morbidity from treatment ranges from between 5% to 25%. Unfortunately only a few of these studies have included measures of acute



or long-term neuropsychological outcome. The current study used a prospective design to evaluate the nature of acute and ongoing cognitive impairment following the treatment of UIAs. Experimental participants ( $n = 25$ ) were tested prior to treatment, in the acute stages of hospitalisation, at three months, six months and, where relevant, at twelve months following treatment. Their performances were compared to age, gender, and ethnicity matched controls. Data was analysed using reliability of change indices and individual case profile analysis. Results indicate that whilst there is much variability in the performance of the treated participants, these participants did experience significantly greater cognitive deficit than matched controls. These effects were, however, moderate and it is concluded that in most cases the risk of cognitive deficit is likely to be out-weighted by the fact that treatment also removes the risk of future haemorrhage.

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#### **S. ADÓLFSDÓTTIR & M.K. JÓNSDÓTTIR. Layperson's Knowledge About the Sequelae of Whiplash.**

Whiplash injuries are common and have even been said to have reached epidemic proportions. According to an Icelandic study the probability of having a whiplash injury in a traffic accident before the age of 70 is 45–64%. Although 70% of those with whiplash injuries recover well, some develop chronic symptoms and seek financial compensation. In this context the question of malingering of symptoms has been raised. In order to successfully malingering the symptomatology of chronic whiplash one has to know the expected constellation of complaints. The purpose of the present study, which was done in Iceland, was to examine the layperson's knowledge of the sequelae of whiplash. Participants were 168 healthy volunteers (aged 18–67) who were randomly divided into three groups. One group was asked to rate the likelihood of each of 30 symptoms after whiplash, the second rated the likelihood of the 30 symptoms in chronic muscle tension in the neck and the third in depression. All participants rated their own experience of the same symptoms. The following hypotheses were tested: Participants 1) have better knowledge of physical than emotional/cognitive symptoms after whiplash, 2) do not expect a specific symptom profile for whiplash, distinguishable from symptoms profiles in the other groups, and 3) experience less symptoms than they expect for the three clinical groups. All hypotheses were supported. There was no relationship between age, education or profession and rating of symptoms. Those having first-hand experience of whiplash rated symptoms no differently than others.

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#### **C. GROTE, E. GEARY, A. BALABANOV, D. BERGEN, A. KANNER, S. PALAC, & M. SMITH. Evidence That the MMPI-2 Differentiates Patients With Epileptic Seizures From Those With Psychogenic Non-epileptic Seizures.**

We investigated if patients with epileptic seizures (ES) scored differently than patients with nonepileptic psychogenic seizures (NES) on the MMPI-2. *Method:* Retrospective chart review revealed 59 patients determined to have only ES, and another 22 patients to have only NES. All patients had completed the MMPI-2. The diagnosis of ES/NES was made by an epileptologist after reviewing inpatient recordings of video/EEG monitoring. MMPI-2 results were analyzed for between-group differences on the validity and clinical scales, and on frequency of "two point codes". MMPI-2 two-point codes were classified as suggestive of a somatoform disorder (SD) if at least two clinical scales were at or greater than a T-score of 65 and if the two-point code type was either 31/13 or 32/23. *Results:* Patients diagnosed with NES were statistically more likely to be female, and older, than patients diagnosed with ES. NES patients obtained significantly ( $p < .05$ ) higher scores on MMPI-2 scales 1 and 3; there were no significant between-group differences on any of the other validity and clinical scales. Thirty-one ES patients had a two-point code, of which 1 was classified as

SD. Sixteen NES patients had a two-point code type, of which 15 were classified as SD. *Conclusions:* We found the MMPI-2 to have good sensitivity and excellent specificity in differentiating patients with ES from those with NES. While the results of this test cannot be exclusively relied on to make a diagnosis of NES, it can provide important corroborative diagnostic information.

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#### **Symposium 7/3:00–4:30 p.m.**

#### **THE EVOLUTION OF COGNITIVE TESTING: WILL NEW RESEARCH AND TECHNOLOGY CAUSE A PARADIGM SHIFT?**

**Organizer and Chair: David S. Tulskey**  
**Discussant: Glenn Smith**

#### **D.S. TULSKY & G. CHELUNE. The Evolution of Cognitive Testing: Will New Research and Technology Cause a Paradigm Shift?**

The evolution of current psychometric measures date to the early 1900's, with the Wechsler Adult Intelligence Scale—III and the Wechsler Memory Scale—III merely representing current examples of this psychometric tradition. The original editions of the Wechsler tests were made up of compilations and extensions of existent tasks and measures. While these tasks have been revised over the years, changes have typically been incremental rather than radical. However, more recent advances in statistical design, methodology, sensitivity to psychosocial issues, and advances in technology have the potential to significantly impact upon standard assessment procedures. The innovative technological advances, largely from outside of the field of psychology have the potential to change how practice is done, if they are modified and implemented for clinical use on a widespread basis. This symposium will review the evolutionary changes in assessment approaches that have occurred and the promise that new procedures hold for the field. Although there will be focus on the development and evolution of the Wechsler Scales, the symposium will have broader implications as speakers will discuss new methods that should improve current assessment techniques in the short-term as well as new innovations that could revolutionize the field in the long-term.

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#### **D.S. TULSKY. Evolution of the Wechsler Scales: Beyond the Third Editions.**

The measurement of intellectual functioning began in the early 1900's and the techniques that were used in these early years set the foundation for the assessment of cognitive functioning throughout this century. These techniques impacted on David Wechsler profoundly and guided his methods of measuring intelligence and memory. Revising cognitive tests as established as the WAIS—III and WMS—III pose unique challenges that are quite different from developing a new, untried test. The Wechsler tests have such a lengthy history and any significant changes in structure that would make them unrecognizable as "Wechsler tests" could cause the data that had been collected using the previous editions to become less relevant. At the same time, the WAIS—III and WMS—III were conformed and this methodology affords new opportunities to improve practice. The normative information provided in the published test manuals did not take full advantage of the potential for change and while the WAIS—III and WMS—III seem to be solid improvements on their predecessors, they maintained the traditional elements and were published as two distinct tests. A broader view of cognitive functioning was not taken. Since publication, joint factor analyses between the WAIS—III and WMS—III have been conducted and have guided the development of more focused, streamlined, empirically derived factors of cognitive functioning that cut across the subtests

on the Wechsler intelligence and memory scales. New composite scores have been derived and additional normative data has been calculated. It is postulated that these scores have greater utility in clinical practice than the more traditional, global IQ scores.

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#### **G. CHELUNE. Clinical Assessment Within the Context of Evidence-Based Medicine.**

Evidence-based medicine has increasingly led clinicians to practice in more cost-effective ways using procedures that have demonstrable value to patient care. As consumers, clinicians are increasingly working with test developers to produce a new generation of psychological tests are both conceptually driven and also provide clinically relevant "tools" for the user. While the Wechsler tests have long provided age-corrections, clinicians are asking for expanded demographic corrections for age, education, gender, and ethnicity so that a patient can not only be compared to the general population but to more homogenous peer groups. Since patients are increasingly followed serially to monitor clinical outcomes, test-retest norms of change are needed to discern differences between simple practice effects, genuine improvements, and when the absence of an expected practice effect may reflect a deficit. To meet the challenges of evidence-based practice, tools are needed that will facilitate decision-making on an individual rather than group basis. Based rate data for discrepancies between scores and tests are especially important for emerging clinical practice and outcomes research. Information on sensitivity, specificity, SpIns and SnOuts, Numbers-Needed-to-Treat, likelihood ratios, and relative risk for various clinical populations will likely become part of the clinician's vernacular in the 21st century. The pressures of cost-containment and clinical efficacy will undoubtedly forge a closer collaborative partnership between test user and test developer in the near-term. Whether the current evolutionary line of psychological assessment will survive long-term is uncertain, and the psychologist of the future may look and practice in radically new ways.

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#### **J.H. RICKER. Cognitive Assessment Advances: Telemedicine and Functional Neuroimaging.**

New technologies offer innovative advantages and benefits for the assessment and retraining of cognitive functioning. Two such technologies are Telemedicine and Functional Neuroimaging. Telemedicine applications are appearing with increasing frequency. Currently, there are several initiatives under way (both research and private ventures) that are examining the provision of assessment and treatment services remotely. Several models of service provision will be reviewed (e.g., teleconferencing, closed-system computer, web-based access), with specific reference to cognitive assessment. Functional brain imaging advances are allowing researchers to investigate the neural substrates of cognitive constructs that had previously been inferred from psychometric tests with clinical populations and animal research. Imaging paradigms for research studies have become often quite dissimilar from clinical tests, even though most clinical tests were developed from experimental and cognitive psychology. This is changing, as more clinically relevant paradigms are finding their way into imaging labs (e.g., modifications of the PASAT, N-back, WCST, and Letter-Number Sequencing). Additional developments in such a direction may allow for functional imaging to be used as an assessment tool. For example, once neurofunctional "markers" or correlates of particular cognitive disturbances have been established, it might be possible to compare an individual's performance to that of populations who are known to be impaired (similar to the manner in which psychometric test results are compared to normative databases or standardization samples). Additional applications of novel techniques (e.g., near-infrared imaging) will also be discussed.

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#### **M.T. SCHULTHEIS. Virtual Reality and Neuropsychological Assessment.**

Virtual reality (VR) is an emerging technology that holds a variety of potential benefits that may allow for new advances in the areas neuropsychological assessment. In particular, VR allows the development of interactive, 3-dimensional, functionally relevant computer-generated environments, which may serve to enhance the ecological validity of current neuropsychological methodology. VR offers numerous unique assets that have the potential to revolutionize current neuropsychological approaches, with VR as a vehicle serving to generate a potential paradigm shift from traditional paper-and-pencil tasks to behavioral observations within interactive, "virtual" environments that simulate the real world. This presentation will discuss current applications and research findings of VR within the fields of physical medicine and rehabilitation, which have provided a foundation of evidence to support the use of VR with clinical populations. In addition pilot findings from two studies conducted with adults with traumatic brain injury using a "Virtual Office" environment and a "Virtual Reality Driving Simulator" will be used to highlight the specific assets offered by VR for neuropsychological assessment, including 1) a mechanism for evaluating naturalistic behavior, 2) opportunity for graduated exposure of stimuli and the ability to objectively record all behavioral responding and 3) safe assessment of complex and potentially hazardous behaviors within the context of functionally relevant scenarios.

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**Symposium 8/3:00–4:30 p.m.**

#### **COMPETITIVE PROCESSES IN PERCEPTION AND ACTION**

**Organizer and Chair: Stephan Pollmann**

#### **S. POLLMANN. Competitive Processes in Perception and Action.**

In every instant, many stimuli in our environment compete for our attention. Likewise, different action plans may compete to be carried out. At a given instant, we can consciously perceive only a fraction of our environment, and we can carry out only one of many competing actions. Thus, resources are devoted to attending to specific aspects of the environment and to carrying out a specific action. Processing of the non-selected stimuli or responses has to wait or is completely dropped. The neural basis of such competitive processes in perception and action are the topic of this symposium. Stimulus competition becomes apparent in the clinical condition of extinction. Hans-Otto Karnath reports a study on the neuroanatomical basis of extinction and its relation to neglect. Salient stimuli may lead to a reallocation of attentional resources between visual dimensions such as color or movement. Stefan Pollmann reports event-related fMRI and patient data on the role of anterior prefrontal cortex on such attention switching processes. Torsten Schubert investigated the contribution of subcortical structures on cognitive and motor components of dual task performance by studying Parkinson patients with deep brain stimulation. Finally, Marcel Brass reports event-related fMRI studies of preparatory and executive components of task switching.

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#### **H.-O. KARNATH & M. HIMMELBACH. The Human Neural Correlate of Extinction.**

Unilateral brain damage may induce the phenomenon of 'extinction'. If two competing stimuli are presented, the more contralesionally located stimulus goes undetected, whereas patients respond appropriately for single stimuli. Previous studies of extinction patients reported lesions affecting the parietal cortex, but also cortical and subcortical damage outside the parietal lobe. However, these studies were insufficient to allow firm conclusions on a possible correlate of the extinction phenomenon. The

definition of key areas of involvement based upon regions of lesion overlap was lacking. In a series of consecutively admitted patients with visual-multimodal extinction, we found sixteen whose cortical lesions had no concurrent involvement of the basal ganglia or the thalamus. Their lesions were mapped and superimposed using MRIcro software. We subtracted the superimposed lesions of the brain-damaged control group without extinction from the overlap image of the extinction group. The resulting lesion overlay revealed a circumscribed center covering the junction area between the caudal part of the temporal cortex and the inferior parietal lobule. A comparison of this area with the cortical correlate of spatial neglect found previously in the middle and rostral parts of the superior temporal gyrus showed clear anatomical differences. The findings suggest that neglect and extinction probably are caused by damage to different functional systems and thus should be treated as separate disorders.

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**S. POLLMANN, R. WEIDNER, K. MAHN, B. REIMANN, & D.Y. VON CRAMON. Frontopolar Contributions to Visual Attention Switching.**

In a series of event-related fMRI studies, we investigated which brain areas support the reallocation of attentional resources between visual dimensions, such as color or motion. Target detection in visual singleton search is slowed when consecutive targets are defined in different visual dimensions. Behavioral data provide evidence that attentional weight needs to be shifted between dimension-specific processing modules. Depending on the type of search, these attentional weight shifts can occur stimulus-driven or top-down controlled. We found a double dissociation in anterior prefrontal cortex: left frontopolar cortex was selectively involved in stimulus-driven dimension changes but not in top-down controlled dimension changes, whereas the reverse was observed in pregenual frontomedian cortex. We then carried out a patient study to investigate the functional significance of the dimension-change-related activation in frontopolar cortex. Patients with frontopolar lesions showed significantly increased reaction times following stimulus-driven dimension changes. We conclude that anterior prefrontal cortex is actively involved in shifts of attention between visual dimensions, with lateral frontopolar cortex supporting stimulus-driven, and pregenual frontomedian cortex top-down-controlled shifts of attention.

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**T. SCHUBERT, C. PREUSCHHOF, & J. VOLKMANN. Effects of Pallidal and Subthalamic Deep Brain Stimulation on Dual-Task Performance in Parkinson's Disease.**

Patients with Parkinson's disease (PD) show severe impairments in the ability to coordinate sensorimotor tasks in dual-task situations. These impairments are often associated with dysfunctions of the basal ganglia-thalamo-cortical circuits. The aim of our project was to elucidate the function of different anatomical substructures of these circuits for the control of dual tasks. For that purpose, we changed the functional states of parts of the basal ganglia with deep brain stimulation (DBS) and investigated its effects on dual-task processing in patients with PD. DBS was targeted to the Globus Pallidus internus (GPi) and to the subthalamic nucleus (STN). 16 PD patients (8 GPi) performed an auditory and a visual choice reaction task either separately or concurrently as a dual task with varying intervals between both tasks (ITI). The manipulation of the ITI and a careful theoretical analysis of the involved processes allowed us separating effects of DBS on motor from that on cognitive components in dual-task performance. As a result DBS improved dual-task performance independently of the ITI in the GPi—as well as in the STN-group, which points to an effect of DBS on motor components during dual-task processing. Additionally, in the STN-group the amount of the improvement increased with increasing cognitive demands in the applied tasks. These results indicate a similar functional role of the GPi and the STN for the

control of motor components during dual-task processing. Additional neural projections to the STN may be responsible for the additional DBS effects on performance control in the STN-group.

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**M. BRASS & D.Y. VON CRAMON. The Role of the Fronto-Lateral Cortex in Task-Rule Implementation.**

The ability to prepare for different task situations is crucial for the voluntary control of our actions. It enables us to react flexibly and rapidly to a changing environment. In the present series of fMRI experiments we wanted to investigate the role of the fronto-lateral cortex in task-preparation. In the first experiment we isolated task-preparation related brain areas from task-execution related brain areas by using a task-cueing paradigm. This experiment showed that the fronto-lateral cortex at the junction of inferior frontal sulcus and inferior precentral sulcus (inferior frontal junction area, IFJ) is involved in task-preparation. In the second experiment we tested whether this involvement was related to the translation of the task-cue into the task-instruction or to the implementation of the task-set. It turned out that the IFJ is involved in the implementation of the task-set but not in the translation of the cue into the task-instruction. In sum, these results strongly indicate that the IFJ is the crucial frontal component for the implementation of task rules.

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**Paper Session 7/3:00–4:30 p.m.**

**EXECUTIVE FUNCTION I**

**T. FERNANDES, C. LOUREIRO, R. DA SILVA, B. DIAS, R. VIEIRA, & I. PAVÃO MARTINS. Switching and Clustering on Verbal Fluency: A Portuguese Developmental Study.**

*Background:* Verbal fluency tasks (VFT) are used in clinical and experimental practice. Most of the previous studies, in phonemic and semantic fluency tasks, considered a unique score: the number of correct items generated. Yet, this index doesn't provide information about the cognitive processes involved on VFT, nor to dissociate the involvement of frontal and temporal lobes on these tasks. Troyer and colleagues proposed two additional indexes: switching and clustering, mediated by frontal and temporal lobes respectively. There are few VFT studies in childhood and none, to our knowledge, analyse Troyer's proposal, since her work was exclusively done with adults. *Objectives:* to outline the developmental performance pattern on VFT in Portuguese population; and to evaluate Troyer's proposal in children. *Methods:* At the moment 178 children with 6–13 years old, from public and private schools, between 1st–6th grades were included. They performed five VFT: two semantic and three phonemic. *Results:* We've found no sex and school differences. The number of correct answers and number of switching in all VFT revealed the developmental pattern expected: significant differences for these scores in all age groups and educational levels. Switching has a strong correlation with the total number of items produced in all tasks, but it is the best predictor for phonemic tasks. Digit span is correlated with the number of correct items produced and switching in all tasks, but not with clustering. *Discussion:* This developmental analysis permits the comprehension of the VFT performance of healthy children and a better understanding of developmental neuropsychological cases.

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**H. HILDEBRANDT, B. BROKATE, & T. TERNES. Executive Functions in Multiple Sclerosis.**

During the past years, research has focused the attention on the cognitive deficits in patients with MS. The present study compares how 40 MS



patients and 18 controls performed in tests on executive function, verbal memory and cognitive processing velocity. In addition we gathered data on depression and the extent of psychosomatic complaints in the MS group. Our thesis was that since MS-specific focal neuronitis is often found in the area of the periventricular cerebral white matter, this should lead to impairments particularly in working memory and executive functions. The analysis revealed a significant correlation between the patients' clinical status (EDSS score), cognitive processing speed, and recall from verbal memory. Patients with secondary chronic progressive MS were impaired in virtually all parameters of executive functions. We found a significant difference in a simple working memory task and a reaction alteration task for the MS group as a whole and for the group with relapsing-remitting MS. The study shows that MS patients suffer from cognitive deficits in significantly large numbers. It also shows that it might be possible to differentiate the stages and make assessments of the course of the disease and the general pathogenic type of MS by means of specific neuropsychological procedures.

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**B.B. QUEDNOW, K.-U. KÜHN, C. HOPPE, W. MAIER, & M. WAGNER. Neurotoxicity of MDMA ("Ecstasy"): Does Recreational Use of MDMA Elevate Impulsivity and Impair Decision-Making Cognition?**

In animal studies the designer drug "Ecstasy" (3,4-Methylenedioxymethamphetamine, MDMA) caused loss of presynaptic serotonergic neurons. Several studies have shown that recreational MDMA consumed leads to alterations in the human serotonergic system, too. Furthermore, executive functions like decision-making cognition and impulsivity are linked to monoaminergic mechanisms. In a previous study abstinent MDMA users showed elevated impulsivity but executive functions in MDMA consumers are not studied so far. The aim of the present study was to study impulsivity and decision-making cognition of abstinent MDMA users in order to investigate the involvement of the serotonergic systems on these cognitive functions. 18 male, abstinent MDMA users, 18 male, abstinent Cannabis users and 18 male healthy controls without any drug experience were examined by the Matching Familiar Figures Task (MFF 12) for impulsivity and the Damsio-Gambling Task (DGT) for executive functioning. Compared to healthy controls, MDMA users showed only a slightly and not significant elevated impulsivity reflected in the an error-reaction time-ratio of the pattern-matching task MFF 12. Cannabis users showed no altered impulsivity compared to healthy controls. In the decision-making task DGT, MDMA users showed significant lower performance than cannabis consumers or healthy controls. The cannabis users showed no different performance in decision-making compared to healthy controls. The performance in the decision-making task was correlated with years of MDMA consumed, as longer duration of abuse led to worsening performance. These results suggest that the recreational use of MDMA impairs executive cognitive functions. The decision-making deficit of MDMA consumers is probably due to a loss of serotonergic neurons.

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**B. REUTER, J. HEISS, M. JÄGER, R. BOTTLENDER, G. GOLDENBERG, & N. KATHMANN. Impaired Executive Control of Eye Movements in Schizophrenia and Frontal Lobe Injuries: Is it Just Inhibition?**

Schizophrenic patients show similar executive dysfunctions as brain-injured patients with frontal lobe damage. It is however still unexplained how different specific processes interact for impaired performance in the complex tasks that are typically used to test executive functions. In oculomotor studies, for example, patients of both groups show considerable difficulties to execute saccades to the mirror position of a suddenly occurring peripheral stimulus (antisaccades). These could either be due to a) a deficit in inhibiting the reflex-like saccade towards the stimulus, b) a deficit in generating the more voluntary antisaccade, or c) some unknown interaction of both processes. In a recent study we found that an inhibition

deficit is more likely to explain errors in the antisaccade task than a pure generation deficit, but that generation may be additionally impaired in a subgroup of schizophrenic patients. The applied approach was to temporally separate inhibition and generation by inserting a delay between stimulus onset and an additional imperative signal for the response (Delayed Antisaccade Task). This approach was now extended by a Delayed Prosaccade Task where a saccade towards the peripheral stimulus is wanted after the delay. All tasks were presented to patients with schizophrenia or with different frontal lobe injuries and control subjects. First results show similar deficits of both patient groups in the delayed antisaccade task. Strikingly, inhibition errors (unwanted prosaccades during delay) are even higher in the prosaccade task. These and further results illustrate the prominent role of a differentiated concept of inhibition within the context of executive dysfunction.

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**M. RIEGER. A Role for the Right Frontal Lobes in the Inhibition of Ongoing Responses?**

The aim of this study was to investigate the role of the frontal lobes and the basal ganglia in the inhibition of ongoing responses. 17 patients with frontal lesions (FG), 20 patients with lesions outside the frontal cortex (NFG), 8 patients with lesions to the basal ganglia (BG), and 20 orthopedic controls (OG) performed the stop-signal task that allows the estimation of the time it takes to inhibit an ongoing reaction (stop signal reaction time, SSRT). The FG, as well as the BG, showed significantly longer SSRTs than the OG. Within the FG, patients with right and bilateral lesions showed significantly longer SSRTs than patients with left lesions. Primary task reaction time (RT) and SSRT were moderately correlated. However, group differences in SSRT did not disappear when controlling for differences in primary task RT. Results provide some evidence for a role of the frontal lobes and the basal ganglia in the inhibition of ongoing reactions. They further indicate, that it might be the right frontal lobe which is of more importance for this function.

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**R. LOOSE, C. KAUFMANN, O. TUCHA, D.P. AUER, & K.W. LANGE. fMRI Brain Activity During Task Switching: The Role of Performance Speed.**

Functional magnetic resonance imaging (fMRI) was used in 14 healthy subjects to measure brain activity during the performance of a task-set switch. During the activation phase, subjects were asked to switch their attention between two different types of visually presented stimuli. During the baseline phase, subjects were required to attend to one stimulus type. Subjects responded by pressing a left or right key according to the position of the target stimuli. Stimuli were presented for 750 and 1500 ms, respectively. Reaction times increased significantly during task switching. Switch costs were about 100 ms for the longer inter-stimulus interval (ISI) and 23 ms for the short ISI. Longer reaction times in the short ISI condition leads to an increased number of omissions. Correspondingly, an increased omission number was observed in the short ISI switch condition ( $29.8 \pm 22.1$ ) compared to the non-switch condition ( $11.2 \pm 12.4$ ) and compared to the long ISI switch condition ( $1.6 \pm 2.8$ ). In the long ISI, switching was associated with activation of the parietal lobe (precuneus) and the middle frontal gyrus (brodmann area 6), particularly in the left hemisphere. Switching in the short ISI was associated with markedly increased activity in the same regions of both hemispheres. Additional brain activity was shown in the short ISI in the right inferior frontal gyrus (brodmann area 47). Response selection may be associated with premotor activity in the middle frontal gyrus. Right prefrontal brain activation associated with executive top-down attentional control mechanisms may appear particularly during higher performance speed.

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Paper Session 8/3:00–4:30 p.m.

## NEURODEGENERATIVE DISORDERS AND DEMENTIA I

### G.J. CAMPLIN, M.M. SALING, & G.R. SAVAGE. Recognition of Associates in Alzheimer's Disease: An Alternative to Cued-Recall?

Research has demonstrated the essential role of the medial temporal lobes (MTL) in the formation of relational (episodic) memories. MTL structures are typically the first to be affected by Alzheimer's disease. Consistently, patients in the preclinical stages of dementia of the Alzheimer type (DAT) perform poorly on traditional cued-recall paired associate learning (PAL) tasks, which assess the ability to bind, encode and retrieve new relational memories. Motivated by the difficulty of discriminating impaired memory encoding from retrieval using cued-recall paradigms, we designed a verbal PAL recognition test based on the assumption that recognition paradigms bypass effortful retrieval processes. The test was designed to load on all aspects of the hippocampal system by requiring recognition judgements to be based more on "remembering" specific associates than simply "knowing" or feeling familiar with either of its constituents. Our hypothesis that the recognition PAL task would be equally as effective as a cued-recall analogue for discriminating early DAT patients from controls was supported. Performances on our recognition task will be compared to those of traditional standardised familiarity-based recognition measures. Our results are consistent with early medial temporal lobe dysfunction in DAT, and a processing interpretation in terms of impairment predominantly affecting encoding rather than retrieval. We argue that recognition PAL paradigms should prove to be powerful clinical tools for identifying MTL dysfunction in the early detection of Alzheimer's disease.

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### E. MARCH, R. WALES, & P. PATTISON. Language Use in DAT and Normal Ageing: The Uses of Nouns and Deixis.

Naming/word-finding difficulties and reduced semantic verbal fluency are among the first signs of language decline in Dementia of the Alzheimer Type—DAT. Assessment of such difficulties is often undertaken by neuropsychological tests, which can fail to reflect a person's communicative abilities. This gap can be bridged by application of discourse studies to DAT. This research investigates language use, specifically the uses of nouns and deixis in spontaneous language production. The word deixis is borrowed from the Greek word *deiktos* meaning "pointing". Deixis can act as a linguistic substitute for nouns by gaining its meaning from the communicative context (e.g., I am here). In this research, language use and its neuropsychological correlates were investigated in 27 mild to moderate Anglo-Saxon Australian DAT patients; and 26 older adults, matched for age (mean = 78.7), education (mean = 8 years) and gender. Subjects were administered four narrative tasks to elicit spontaneous language; and a set of neuropsychological tests. Analyses revealed that the DAT group showed a tendency to overuse spatial deixis, in other words, relied on spatial elements of communicative context more often than the older adults. Importantly, deictic overuse was not necessarily accompanied by a reduced noun use. Finally, language use, as well as its neuropsychological correlates, depended highly on the narrative task under study. The paper concludes the context of communication as an important determinant of language use. The increased reliance of DAT patients on contextual language renders context a crucial element of DAT language research.

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### A. MCKAY, G.R. SAVAGE, C. DAVIS, & A. CASTLES. Examining the Link Between Semantic and Reading Impairments in Semantic Dementia.

Patients with semantic dementia typically demonstrate difficulties in reading aloud irregular words (e.g., "pint"). It has been argued that this poor

reading of irregular words is functionally linked to the degradation of semantic memory observed in these patients. However, the evidence for a functional link has generally been limited to the finding that poor irregular word reading and a semantic impairment co-occur in semantic dementia. In the current study, we attempted to evaluate the functionality of this relationship between reading and semantic impairments in cases of semantic dementia, by examining whether the ability to read a specific irregular word was directly related to the degree of semantic knowledge of that word (i.e., an item-by-item correlation). Four cases who fulfilled criteria for semantic dementia were tested longitudinally using a battery which included standardised neuropsychological tests, measures of reading ability, and tasks which assessed semantic knowledge about the same words that were read aloud. All cases demonstrated impairments of semantic memory and a variable degree of difficulty in reading irregular words. The results will be discussed in relation to the functional link between reading and semantic impairments in semantic dementia, and in other brain-related illnesses involving semantic deficits (e.g., Alzheimer's disease).

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### K. RASCOVSKY, D.P. SALMON, D. GALASKO, G.J. HO, L.A. HANSEN, & L.J. THAL. Disparate Phonemic and Semantic Fluency Deficits in Autopsy-Confirmed FTD and AD.

Previous studies have shown that patients with Alzheimer's disease (AD) have a disproportionate impairment in generating exemplars from semantic categories compared to phonemic categories, while patients with circumscribed frontal lesions have equivalent deficits on both tasks. These patterns are consistent with the notion that frontal lesions produce a general deficit in initiation and retrieval, whereas additional temporal neocortical damage in AD engenders semantic memory deficits that disproportionately affect category fluency performance. Given the extensive frontal lobe deterioration that occurs in frontotemporal dementia (FTD), these patients may exhibit a pattern of verbal fluency deficits more similar to that of patients with circumscribed frontal lesions than that of patients with AD. To address this issue, letter fluency (i.e., FAS) and category fluency (animals, fruits, vegetables) data from 9 autopsy-confirmed FTD patients was compared to that of 18 education and dementia matched autopsy-confirmed AD patients. A significant diagnosis by fluency task interaction effect ( $F(1,25) = 6.32, p < .05$ ) was obtained. FTD patients were more impaired on letter than on category fluency tasks, while AD patients showed the reverse pattern of impairment. Furthermore, AD patients performed better than FTD patients on the letter fluency task. The disparate patterns predicted group membership with 78% accuracy in a logistic regression analysis ( $\chi^2 = 9.76, p < .05$ ) and this disparity increased with increasing severity of dementia. The unique phonemic and semantic fluency deficits exhibited by patients with FTD and AD may be indicative of a greater retrieval deficit in FTD and a disproportionate semantic impairment in AD.

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### M. ALEGRET, M. PILLERI, J.M. MARTÍ, F. VALLDEORIOLA, E. TOLOSA, J. RUMIA, & P. VENDRELL. Opposite Effects on Verbal Fluency Between Two Treatments in Parkinson's Disease.

Chronic bilateral subthalamic deep brain stimulation (STN-DBS) and continuous infusion of apomorphine (IA) are known to improve motor function in patients with Parkinson's disease (PD). Although both treatments provide continuous effects and allow reducing levodopa dosage, they produce different changes on basal ganglia. So, the aim of the present study was to compare the neuropsychological effects of STN-DBS and IA in PD. We included two groups of 7 patients' candidates for STN-DBS and IA, respectively. Both groups were paired by age, sex and educational level. The following neuropsychological tests were administered before (3 days) and after (6 months) treatment: Rey's Auditory-Verbal Learning Test, Benton's Visual Retention Test, Stroop, Luria's motor alternances, Judgment

of Line Orientation, Trail Making, phonetic verbal fluency (PVF) and Beck's Depression Questionnaire. We performed a repeated measures analysis of variance with two factors: 'treatment' (STN-DBS and IA) and 'time' (before and after treatment). We only found a significant interaction between 'treatment' and 'time' on PVF ( $F(1,12) = 5.321, P = .040$ ). Specifically, STN-DBS deteriorated, while IA improved, PVF performance. Moreover, a significant improvement of motor scores was found in both groups, but dyskinesias were only reduced in patients submitted to STN-DBS. Our results suggest that STN-DBS and IA produce opposite effects on PVF. Although only STN-DBS improved dyskinesias, motor changes were similar in both groups. So, if we consider that STN-DBS surgical treatment has a potentially increased risk and it produces a moderate PVF deterioration, we could conclude that IA is a good alternative in the treat-

ment of advanced Parkinson's disease in which the worst symptom is not dyskinesias.

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**Presidential Address/5:00–5:45 p.m.**

## **CORTICAL DEGENERATIVE CONDITIONS: A NEUROPSYCHOLOGIST'S PERSPECTIVE**

**Elisabeth Warrington**

**Friday Morning, July 18, 2003**

**Plenary Session 4/9:00–9:45 a.m.**

## **COGNITIVE NEUROSCIENCE AND BRAIN REHABILITATION: A PROMISE KEPT**

**Ian H. Robertson**

**Poster Session 3/9:00 a.m.–12:30 p.m.**

## **NEUROPSYCHOLOGICAL OUTCOME**

**M. BÖCKER, S. GAUGGEL, P. ZIMMERMANN, C. PRIVOU, & D. LUTZ. Measurement Characteristics of the Functional Independence Measure.**

The rating of activity limitations in patients is an important aspect in the International Classification of Functioning, Disability and Health (ICF). The Functional Independence Measure (FIM) and the Barthel Index (BI) are the most commonly used measures for this purpose. In this study the measurement characteristics of the FIM were investigated using Rasch analysis. Participants were a consecutive series of 166 neurological patients admitted to an inpatient rehabilitation center. The nursing staff of the rehabilitation center rated the level of independence of patient's performance on each of the 18 FIM items. An initial Rasch analysis was performed to quantify a single measurement scale of activity limitations. Similar to the results of earlier studies carried out in the United States (e.g., Linacre, Heinemann, Wright, Granger, & Hamilton, 1994) we found that the 18 FIM items don't define a single construct of activity limitation but rather two statistically and clinically different indicators. Whereas the first 13 FIM items measure physical activity limitations, the remaining five items define cognitive activity limitations. Accordingly, two separate Rasch analyses, first of the 13 motor items, and second of the five cognitive items, were performed. Separating the motor and cognitive items into two different FIM indicators improves the measurement capability of the FIM.

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**S. GEYH, A. CIEZA, N. KOSTANJSEK, T. EWERT, & G. STUCKI. Linking the Functional Independence Measure and the Barthel Index to the ICF.**

With its ICF model of functioning and disability, the World Health Organization provides a generally accepted, multidimensional framework for the understanding of patients' health status. Research in the field of

neurological-neuropsychological rehabilitation referring to this model increasingly demonstrates that basic senso-motoric and cognitive impairments do not sufficiently predict the need for care or success of rehabilitation. Consequently, the assessment of areas corresponding to the ICF dimension of activity has gained in importance. With the approval of the International Classification of Functioning Disability and Health (ICF) by the World Health Assembly in May 2001 the concurrent use of both disability measures and the ICF is expected. It is, therefore, important to understand the relationship between them. There are two prominent instruments measuring activity limitations which are widely-used in neurorehabilitation: The Barthel Index and the Functional Independence Measure. The aim of this research is to connect the Barthel Index and FIM to the ICF on the basis of linking rules specifically developed for this purpose. It could be shown that the results of the linking procedure not only reflect the structure and the subject matter, but also clarify the relationship between the two scales. The ICF, as a common language, makes it possible to connect different instruments, to integrate them into the same framework, and thereby to advance assessment, clinical practice, and research in neurorehabilitation.

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**T. LEIM, B. STEMMER, S. LACHER, & P.W. SCHÖNLE. Does Early Use of Assessment Tools Predict Vocational Outcome After Stroke?**

The objective of our research was to investigate whether rating scales and neuropsychological measures employed early in the rehabilitation process predict vocational outcome of non-aphasic stroke patients 12 months after discharge from neurological rehabilitation. We investigated 144 first time non-aphasic stroke patients at the time of admission and 12 months after discharge using a variety of rating scales (FIM, NBR, PSV, CDS, ESS) and neuropsychological tests (TAP, d2, TMT, Organisation task, WMS, WCST). 12 months after discharge 57 patients were professionally engaged and 87 were not. At the time of admission vocational outcome was best predicted by FIM, ESS and CDS (rating scales) and the organization task and the TMT-A (neuropsychological tests). These results indicate that it is not sufficient to evaluate non-aphasic stroke patients using only one measure—as is frequently done in routine clinical assessment—but a combination of tools is necessary incorporating motor, cognitive and emotional aspects. Best early predictors for vocational rehabilitation of non-aphasic stroke patients proved to be tools that combined these aspects. Limitations of our research will also be discussed.

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**A. BOUMA. Behavioral and Psychosocial Consequences After Stroke.** This study was designed to get more insight into the problems as experienced by stroke patients and their partners. The judgments of left-hemisphere stroke (LHS) subjects were compared to those of right-hemisphere stroke (RHS) subjects. After stroke, a large number of behavioral and emotional changes were observed in the patients, however, LHS patients were generally less aware of their disturbances than RHS patients. Moreover, RHS patients were more depressed and more anxious than LHS patients. We also observed significant changes in the social activities of both patients and partners. The results further revealed that coping strategies employed by the patients were significantly related to those of their partners. The implications of the present findings for neuropsychological rehabilitation will be discussed.

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**C. KARLOWSKY, M. BRÜGMANN, J.M. GILSBACH, & B.O. HÜTER. Neuropsychological Deficits in Patients With Hydrocephalus After Subarachnoid Hemorrhage.**

**Background:** We investigated the neuropsychological late sequelae of acute hydrocephalus after subarachnoid hemorrhage. **Methods:** 110 adult patients after subarachnoid hemorrhage (SAH) were examined neuropsychologically. 20 (18.2%) of them presented with hydrocephalus in the acute stage. Both groups were matched according to age, gender, initial clinical state and neurological result, rated by Glasgow Outcome Scale (GOS). We used a standard German concentration test (d2) and a computerized attention battery (TAP). Memory was assessed by Recurring Words, Recurring Figures and LGT3. Token Test was used in order to control the effect of aphasia in verbal memory tasks. **Results:** Patients with hydrocephalus performed worse in figural ( $p < .05$ ) and verbal ( $p = .03$ ) short term memory as well as in long term memory (figural  $p = .04$ ; verbal  $p < .05$ ). Concentration (d2) was reduced in speed ( $p = .01$ ) and accuracy ( $p < .01$ ). Hydrocephalus patients made significantly more errors in divided attention ( $p < .01$ ) and the Go-No-Go task ( $p = .04$ ). Furthermore their reaction times in the Go-No-Go task were significantly worse ( $p = .03$ ). **Discussion:** Our results show that acute hydrocephalus, even if transient, had substantial and persistent adverse effects on late neuropsychological performance.

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**J. ALLEN & J. MULCARE. Personality Assessment Inventory (PAI) Profiles in Individuals With MS.**

The Personality Assessment Inventory (PAI) was administered to 18 individuals with Multiple Sclerosis (mean age = 48 years) undergoing evaluation of current physical activity levels as a means of assessing the potential impact of the disease process on psychological status. The most notable finding in this domain was the elevation on the Somatic Complaints (SOM) clinical scale of the PAI. The clinical sample obtained a mean T-score value of 66.8 on the SOM dimension of the PAI. This T-score value places the participants in the present study at approximately the 96th percentile normatively, and suggests that physical complaints are a significant focus for the population. Importantly, this may also serve to decrease their identification of symptoms, events or activities that have a non-medical origin. Again, this could decrease the completeness or accuracy of self-report. Within the SOM scale, specific areas of concern can be further broken down into symptoms of conversion, somatization, and health concerns. While each of these subscales showed some elevation above scores obtained by the standardization sample, the Conversion Subscale was most elevated (T-Score = 72.56). This suggests that sensory and motor complaints may be dominant and may supercede the reporting of other types of distress. Graphic and numeric summaries of PAI profiles of the MS sample were completed. Clinical and research implications are also discussed. Correspondence: *Jeffery Allen, SOPP, Wright State University, 3640 Colonel Glenn Highway, Dayton, OH 45435-0001, USA.*

**C. KARLOWSKY, M. BRÜGMANN, J.M. GILSBACH, & B.O. HÜTER. Quality of Life in Patients With Hydrocephalus After Subarachnoid Haemorrhage.**

**Background:** Our aim was to investigate the influence of an acute hydrocephalus after subarachnoid hemorrhage (SAH) on Health Related Quality of Life (HRQoL) and psychological adjustment. **Methods:** We examined 110 adult patients after SAH. 20 (18.2%) of them developed an acute transient hydrocephalus. The two groups were matched in terms of age, gender, initial clinical state (Hunt & Hess Score) and neurological results, rated by Glasgow Outcome Scale (GOS). The following psychosocial measures were employed: Aachen Life Quality Inventory (ALQI), Beck Depression Inventory (BDI), Hamilton Depression Rating (HDR), Freiburger Personality Inventory (FPI) and the Fragebogen zur Krankheitsverarbeitung (FKV). **Results:** Patients with hydrocephalus had a significantly worse overall HRQoL. This difference was statistically significant in the physical and psychosocial score as well as in 8 of the 10 subscales of the ALQI ( $p < .05$ ; respectively). If hydrocephalus emerged in the acute stage, patients showed more often depressive symptoms (BDI  $p < .01$ ; HDR  $p = .02$ ). Apart from aggressiveness ( $p = .03$ ) bodily complaints ( $p < .05$ ) and religiousness ( $p = .02$ ) no substantial differences in further aspects of coping (FKV) emerged. **Discussion:** The impact of acute hydrocephalus after SAH (even if transient) on HRQoL and psychological adjustment suggests more attention in rehabilitation and therapy.

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**J. JUNCADILLA, G. ESCARTIN, C. SORIANO, & J. MONFORT. Speed Processing Index (WAIS-III) in Severe and Moderate Traumatic Brain Injury After One Year.**

**Introduction:** The slowing down of information processing is characteristically one of the most frequent and persistent neuropsychological dysfunctions associated with traumatic brain injury patients. **Methods:** 23 TBI patients (Age 25.96, SD = 6.95, schooling 11.17, SD = 3.1). A control group consisted of 19 subjects (Age 25.89 SD = 11.04, schooling 11.11 SD = 2.45). The Glasgow Coma Scale was considered moderate to severe, and the traumatic coma data bank was 2. The neuropsychological assessment was carried out a year after the accident; the Pasat version G, Trail Making Test, the Stroop test and the speed information processing index WAIS-III. **Results:** A logistic regression analysis was used to identify the best predictors of patients and control group. Although all the variables obtained from the TBI and the control group were significantly different with a selection forward stepwise, the variable of speed processing was only included in the final model. This model classified correctly. 69.6% traumatic patients and 73.7% of the group control ( $\chi^2 = 15.81, p < .0005$ ). A linear regression analysis was carried out to study which variable discriminated better according to the severity of the injury, using a selection forward stepwise the final model only included the pasat 1 variable. **Conclusions:** The speed of information processing index (WAIS-III) was the test that best discriminated between brain injury and controls. The test that best discriminated the severity of injury in relation to posttraumatic amnesia was PASAT series 1.

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**E.D. BIGLER. Neuropsychological Findings in a Case of Autopsy Confirmed Neuropathology in Mild Traumatic Brain Injury.**

Autopsy studies were undertaken in a 47 year old college-educated male patient who seven months prior to an unexpected death had sustained a mild traumatic brain injury (TBI) as manifested by brief loss of consciousness and an initial Glasgow Coma Scale score of 14. The patient died from cardiac arrest secondary to ischemic heart disease due to arteriosclerotic cardiovascular disease. Gross inspection of the brain at autopsy was normal; however, microscopic analysis demonstrated hemosiderin-laden macrophages in the perivascular space and macrophages in the white matter, particularly the section taken from the frontal lobe. The patient had par-

tially returned to work at the time of death, but had encountered problems with diminished cognitive performance in his work as a real estate appraiser. Neuropsychological studies were generally within normal limits although several tests of either speed of processing or short-term memory showed lower than expected performance. This case demonstrates the presence of subtle neuropathological changes in the brain of a patient who sustained a mild TBI and was still symptomatic for the residual effects of the injury seven months post-injury when he unexpectedly died.

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## PHARMACOTHERAPY AND NEUROPSYCHOLOGY

### P. ALHOLA, R. PORTIN, R. ERKKOLA, & P. POLO-KANTOLA. The Effect of Long-Term Estrogen Replacement Therapy on Cognition.

**Objectives:** The purpose of the study was to evaluate the effect of long-term estrogen replacement therapy (ERT) on cognitive functioning. **Methods:** Sixty-two healthy postmenopausal women participated in a large study of cognition and sleep during years 1994–1996. After 5 years they were recontacted and 60 women agreed to participate in the present study (mean age 61 years). The use of ERT for last 5 years served as a criterion for study groups. During the past five years, twenty-one women had used ERT (ERT-users) and 18 women had not (non-users). Among 21 women the use of ERT had been irregular, and they were excluded from the study. The study was single-blind, and consisted of measurements in verbal and visuomotor performance, episodic memory and attention. **Results:** As compared with their baseline measurements five years earlier, the ERT-users had maintained reaction times in two basic tasks better than non-users (2-choice reaction time  $p = .031$ , 10-choice reaction time  $p = .069$ ). In the visual-verbal test of object naming the reaction times had increased in ERT-users (4.4 sec) but decreased in non-users (1.7 sec,  $p = .037$ ). ERT-users also recalled fewer objects ( $-0.5$ ) than non-users (1.1,  $p = .041$ ). The cognitive test battery comprised of several other attentional, visuomotor and memory tests (18 additional tests), in which, however, the groups did not differ. **Conclusions:** Cognitive performance is well maintained after menopause. The findings in the comprehensive test battery were sparse and random. Thus, the use of ERT does not give any advantage in preservation of cognitive capacity.

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### T. BENKE, B. KÖYLÜ, M. DELAZER, E. TRINKA, & G. KEMMLER. Cholinergic Treatment of Amnesia Following Basal Forebrain Lesion Due to Aneurysm Rupture—A Pilot Study.

**Background:** Impairments of memory are often found after rupture and repair of aneurysms leading to a basal forebrain lesion. Cholinergic substitution therapy may be a treatment option which has previously not been evaluated. **Methods:** The effect of donepezil, a cholinesterase inhibitor on memory functions was tested in an open-label, exploratory study in eleven patients with a chronic amnesic syndrome from a ruptured and repaired aneurysm of the anterior communicating artery (7 patients), the anterior cerebral (2) or the pericallosal artery (2). Mean time since onset was 75.4 months. Memory was evaluated at baseline and consecutively after 4 weeks of 5mg donepezil daily, 8 weeks of 10 mg donepezil, and 4 weeks after drug discontinuation. Memory functions were assessed using the California Verbal Learning Test and compared with a matched group of normal, untreated controls. Tests of attention and of executive functions were also administered. **Results:** Donepezil was well tolerated. Strong group effects were found at baseline and at all follow-up measurements. Within patient statistics showed significant improvements of short and long delay free recall scores during the treatment period, both with 5 and 10 mg donepezil daily, whereas attentional and executive functions improved only nonsignificantly. Memory functions decreased after drug discontinuation. Repeated test administration in the control group also showed an increase of memory scores which was only minor as compared to the performance

change in the patient group. **Conclusions:** Donepezil may improve memory in patients suffering from a chronic amnesic syndrome following vascular basal forebrain lesions. Future doubled-blind, placebo-controlled trials are warranted to confirm these findings.

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### C. BREITENSTEIN, S. WAILKE, S. BUSHUVEN, S. KAMPING, P. ZWITSERLOOD, & S. KNECHT. Effects of D-Amphetamine on Plasticity of Language Networks in Healthy Adults.

D-amphetamine is among the most effective drugs in motor recovery post stroke in humans. We investigated the effects of d-amphetamine on speed of language acquisition in healthy adults, with the long-term perspective of enhancing functional language recovery after stroke. Using a prospective, randomized, double-blind and placebo-controlled design, we taught 40 male healthy subjects an artificial vocabulary of 50 concrete nouns over the course of five consecutive training days. The learning principle is based on associative learning mechanisms and involves higher co-occurrences of “correct” picture-pseudoword pairings as compared to “incorrect” pairings. Subjects received either d-amphetamine (0.25 mg/kg) or placebo 90 min prior to training on each of the five days. Stability of learning was reassessed after 1 week and 1 month. Novel word learning was significantly enhanced in the d-amphetamine group as compared to the placebo group, and learning superiority was maintained at the two re-assessments. There were no serious adverse reactions to d-amphetamine. Together with preliminary evidence for the efficacy of d-amphetamine in recovery of aphasia symptoms after stroke, our results indicate that the range of applications of d-amphetamine to enhance learning and plasticity in humans is extensive.

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### M. TALLUS, P. ALHOLA, R. PORTIN, & P. POLO-KANTOLA. Hormone Replacement Therapy Impairs Vigilance During Acute Sleep Deprivation.

Acute sleep deprivation (SD) has a detrimental effect on reaction times (RTs) and vigilance. Subjective sleepiness increases as sleep deprivation continues. The objective of this study was to evaluate whether HRT has a blunting effect on acute SD evoked stress response, reflected in vigilance and subjective sleepiness. 18 healthy postmenopausal women volunteered for the study (12 HRT-users, 6 non-users). Cognitive processing was measured by CogniSpeed vigilance test. Stanford Sleepiness Scale (SSS) was completed 31 and the vigilance test 11 times. The study consisted of adaptation, baseline, sleep deprivation and rebound nights. **Results:** At baseline, RTs in the vigilance test were similar in HRT-users and non-users. After 18 hours of SD/the RTs of HRT-users started to increase. After the rebound night, they were back to baseline levels. Eight hours after the baseline measurement of vigilance, and from 18 hours of SD on, the number of omission errors in the HRT-group was increased as well. This phenomenon disappeared after the rebound night. The RTs and number of omission errors did not differ between measurements in the group of non-users. Subjective sleepiness measured by SSS remained similar throughout the study in both groups. **Conclusions:** Vigilance is impaired after acute SD in postmenopausal on HRT, but no such effect is found in non-users.

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## REHABILITATION

### S. FISCHER, L.E. TREXLER, & S. GAUGGEL. Awareness of Activity Limitations in Patients With Brain Injuries and Patients With Orthopedic Disorders.

The aim of this study was to improve the assessment of awareness deficits. Therefore, we compared the accuracy of performance predictions in ex-

perimental tasks with patients' awareness of activity limitations. Participants were 24 patients with brain-injuries (i.e., traumatic brain injury and cerebrovascular disorders) and 22 patients with orthopedic disorders. Prediction of performance was examined in a memory task (word list learning) and a motor task (finger tapping). Awareness of activity limitations was measured by comparing patients' self-ratings and staff ratings in the Patient Competency Rating Scale (PCRS). Results for the PCRS showed that orthopedic patients underestimated and brain-injured patients (i.e., patients with TBI) overestimated their level of functioning in the total scale and the subscale "social/emotional" in comparison to staff ratings. Both patient groups agreed with staff ratings in "physical/basic self-care" items. In the predicted performance tasks a similar pattern could be observed: None of the groups showed an overestimation of performance in the motor task, whereas patients with brain-injuries overestimated their competency in the memory task. However, the agreement between both awareness measures (PCRS, predicted performance) was only low, which indicates that they might measure different aspects or levels of self-awareness.

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**M. HOOP, A. NEUMANN, N. JOOSTEN, S. GAUGGEL. Apathy after TBI and CVA: Relationship Between Questionnaire Approach and Objective Activity Measurement.**

Apathy is a frequent behavioral disorder in patients with brain injuries and can negatively influence rehabilitation outcome. According to Marin (1990) apathy is defined as a lack of motivation on three levels: decreased goal-directed behavior (e.g., lack of effort), decreased goal-directed cognition (e.g., lack of interest) and decreased emotional concomitants of goal-directed behavior (e.g., unchanging affect). The Apathy Evaluation Scale (AES; Marin, 1991) is a frequently used questionnaire to assess the different characteristics of apathy. The aim of the present study was to identify if patients who show high apathy scores on an extended German version of the AES also show lower motor activity in everyday life as measured by activity recording (actigraph). Participants are 50 patients with either traumatic brain injuries or cerebrovascular accidents who are at least one year post-injury and are living at home. Results indicate a moderately high correlation between AES and actigraph data. Correlation between activity data and AES ratings of relatives were higher than correlation between activity data and AES patient ratings. Our findings indicate that activity recordings assess only one aspect of apathy (i.e., general motor activity of one upper extremity), whereas the AES is focused on goal directed behavior on different levels.

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**C. BOHN & N. STADIE. Rehabilitation in Pure Alexia: Perceptual Cues Facilitate Holistic Word Recognition.**

One account for acquired pure alexia (PA) is a peripheral deficit affecting low-level perceptual processing in reading, prior to intact orthographic word representations (Farah & Wallace, 1991). Sekuler and Behrmann (1996) argue that the deficits associated with PA are particularly noticeable in perceptual contexts that lack strong perceptual cues such as reading. Thus, it may be possible to facilitate holistic word reading in PA by adding strong perceptual cues that enable patients to "chunk" multiple letters of a word. The present study explored intervention techniques for improving holistic word recognition. A cross-over therapy study adding or subtracting colour to manipulate the perceptual context of target words was investigated with a 65 year-old male with PA due to a posterior cerebral lesion, showing a "letter-by-letter" reading strategy. Following recent work by Friedmann and Lott (2000), therapy method 1 employed rapid presentation of words (30 ms) differing in length requiring word identification. Method 2 extended method 1 by adding colour as a perceptual grouping cue in each stimulus. We hypothesised that compared to method 1, visually cued activation of the link between perceptual process-

ing and orthographic representations leads to a significantly higher increase of reading speed and accuracy and decrease of word length effect. Results and possible generalisation of those effects in reading for PA patients will be discussed.

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**M. BULLA-HELLWIG, C.E. WUTTKE, & I. AUE. Locus of Control and Social Support Predict Family Needs Following Traumatic Brain Injury.**

**Objectives:** To determine how families of long-term patients with traumatic brain injury (TBI) rate their needs for and satisfaction with medical information as well as emotional, professional, instrumental and social network support. To identify families at risk for unmet needs. **Subjects and Methods:** 33 relatives of patients with moderate to severe TBI (time since injury 16 to 180 months, mean 66.8 months) completed the Family Needs Questionnaire (FNQ), a German locus of control questionnaire (Fragebogen zur Kompetenz- und Kontrollüberzeugung, FKK), the Everyday Neuropsychological Dysfunctions Questionnaire and a questionnaire on demographic and social support data. **Results:** 79% of FNQ items were rated as important; 31% of important needs were rated as partly met, 39% were not met. Looking at important needs, multiple regression analyses revealed that medical injury data (e.g., time post injury, severity) and family ratings of neuro-psychological dysfunction did not predict the percentage of partly met or unmet family needs whereas internal and external control variables did. In addition, perceived loneliness, rather than the size of the social network, was associated with unmet family needs. Relatives with low self-expectancies and strong beliefs in powerful others felt more lonely and reported more unmet needs for support than relatives with normal locus of control values, whereas both groups reported the same amount of needs for medical information. **Conclusions:** Family needs extend well beyond the acute setting. Subjective appraisal of low self-expectancy and strong beliefs in powerful others as well as perceived loneliness put families at risk for unmet support needs. Family intervention programmes should take these subjective appraisals and needs into account, e.g., when addressing and motivating relatives to participate.

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**M.E.A. FALEAFA & J.A. OGDEN. Traumatic Brain Injury Rehabilitation Outcomes Across Cultures in New Zealand.**

Indigenous Maori and other migrating Polynesians from nearby Pacific Islands add to a unique ethnic melting pot found only in Aotearoa, New Zealand. While research in other disciplines is increasingly beginning to reflect this cultural development, the advancement of Neuropsychology and clinical psychology is lagging. The present study is the first that takes into account the inter-cultural make-up of brain-injured individuals in neurorehabilitation, unique to New Zealand. The epidemiology of Traumatic Brain Injury (TBI) represents a significant public health problem in New Zealand and Maori and Pacific Peoples are ethnic minorities that are disproportionately over-represented in the prevalence of brain injury. The present study is an exploratory investigation into the needs and experiences of Maori, Pacific and Pakeha (white/European) people who have sustained a mild to moderate TBI and are receiving rehabilitation in the post-acute stages of recovery. The major aims are twofold: (1) to determine whether community-based rehabilitation outcomes following TBI differ across Māori, Pacific and Pakeha (White/European) cultures; and (2) to determine and identify any service delivery needs for Māori and Pacific people in traumatic brain injury rehabilitation that are distinct from Pakeha. The emphasis is on psychosocial outcomes utilising measures such as the Brain Injury Community Rehabilitation Outcome-39 Scale, the BDI-II, the Impacts of Events Scale-Revised, a Client Satisfaction Questionnaire, the Neurobehavioural Cognitive Status Examination, and a semi-structured interview. Results and socio-cultural explanations for out-



comes will be presented along with cross-cultural implications for appropriate neurorehabilitation service delivery.

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**M. KELLER, U. KLEMENT, J. KESSELRING, & G. GUTTMANN. Improvement of Driving Abilities in Neurological Patients After Training With the Driving-Simulator "Smart".**

It is getting more and more important for people after a traumatic brain injury to be able to drive a car. The aim of rehabilitation is to train motorical and cognitive functions and prepare the conditions for going back to work and master their daily life. For this reintegration sometimes it is important that people can drive a car. For neurological patients driving often has the meaning of personal mobility and independence. We made a lot of experiences in using different possibilities to train the necessary cognitive functions for driving. In this work we describe a training with the driving-simulator "smart" and the outcome. The main questions are: 1. Can we see any improvement of driving abilities in normal persons after training with the simulator? 2. Is there a significant improvement of driving abilities in neurological patients after training with the simulator? 3. Do neurological patients find it useful to train with the driving simulator? At the end of their rehabilitation a group of neurological patients ( $n = 15$ ) get a training with the driving simulator "smart". Also do a group of normal persons ( $n = 15$ ) with a valid driving licence. The driving abilities are measured before and after training. After the training the patients answered a questionnaire about the driving situation with the simulator "smart". The results will be presented and discussed.

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**M. ARNOLD, E.M. MÜLLER-OEHRING, E. KASTEN, & B.A. SABEL. Visual Restitution Training in Visuo-Spatial Neglect—A Single Case Study.**

*Aim:* To develop an effective computer-based home-training for patients with visuo-spatial hemineglect we tested the assumption that systematic stimulation of the neglected visual field (NVF) improves left-sided stimulus detection by activating the right hemisphere and thus reducing the imbalance in interhemispheric processing due to unilateral brain damage (Kinsbourne, 1977, 1993). *Patient:* The patient examined was an 47-year-old computer scientist who suffered an atypical intracerebral hemorrhage in the right hemisphere. Neuropsychological testing 10 months post lesion revealed normal intelligence, reduced alertness, a persisting left-sided neglect, and visual extinction phenomenon. High resolution campimetry showed omissions mainly in the NVF. *Methods:* The patient was trained daily for 2 months using an adaptation of the visual restitution training by Kasten et al. (Nature med., 4, 1998). The computer program systematically presents stimuli in the NVF while the patient is fixating a fixation point. Controlling for effects of spontaneous recovery a double baseline was assessed and training started not until 10 months post lesion. *Results:* After two months of training, the patient showed a considerable improvement of stimulus detection in the NVF from 38.5% to 64.9% correct reactions. Overall stimulus detection in both hemifields improved from 51% to 72%. The difference in reaction time for left (crossed) and right (uncrossed) sided stimuli decreased from 150.5 ms to 81 ms. *Conclusion:* The observed training-induced improvement supports Kinsbourne's hypothesis that visuo-spatial neglect results from interhemispheric imbalance in cerebral activation. Systematic stimulation of the NVF may alter interhemispheric activation patterns.

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**M.L. BERTHIER, I. MORENO, J. HINOJOSA, M.C. MARTÍN, & I. FERNÁNDEZ. Effects of Donepezil and Modality-Specific Therapy on STM-Based Repetition Disorder.**

Donepezil hydrochloride (D-HCl), a reversible acetylcholinesterase inhibitor with a selective central action, may be effective and safe in ameliorating language deficits in chronic post-stroke aphasia (Berthier et al., 2002).

Modality-specific therapy (M-ST) is a technique requiring intensive practice of barely accessible language channels (i.e., training repetition in conduction aphasia) to improve language abilities (Kohn et al., 1990). In this study, we used DP-HCl alone followed by combined DP-HCl and M-ST to improve language deficits in 3 patients with chronic post-stroke repetition conduction aphasia. This was a 28-week open-label trial of DP-HCl using an ABAB design (baseline, DP-HCl 5-mg for 4 wks; DP-HCl 10-mg between for 12 wks; withdrawal for 4 wks; DP-HCl 10-mg plus M-ST 1 hour/day for 8 wks). Language evaluations were performed using the description of the "picnic scene" of the WAB and selected experimental test of repetition of words, sentences and lists at baseline and at wks 16, 20 and 28. M-ST consisted of a sentence repetition treatment programme in which two sets of 20 sentences were used. One set contained sentences with rich semantic content (substantives, verbs) and the other set included sentences mainly composed of pronouns, adverbs and functor verbs. All 3 patients showed significant improvement on the description of the "picnic scene" of the WAB and on repetition of experimental sentences and three-word lists, performing better with familiar and meaningful semantic information and reducing the number of formal and semantic errors at wks 16 and 28. Our findings suggest that DP-HCl alone or combined with M-ST improves deficits in spontaneous speech, auditory-verbal STM and lexical-semantic processing.

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**M. BUSCHKÜHL, M. REGARD, & D. HEINEMANN. Influence of Active Movement on Selected Cognitive Tasks.**

We investigated the impact of active movement on cognitive performance in 19 healthy volunteers. Tasks were (1) list learning, (2) serial subtraction, (3) letter and (4) category fluency, each once performed during ergometer cycling and once during rest (counterbalanced). Based on Yerkes & Dodson (1908) we predicted a motor arousal induced facilitation in tasks (2) and (4). Contrary to expectations, the only significant effect was in task (2), where subjects achieved higher scores under rest compared to active movement. We argue that serial subtraction was too demanding to allow the occurrence of a facilitation effect. The results thus raise the possibility that it is the level of task demand, rather than the type of cognitive domain, which is the primary factor in determining the susceptibility of a task to modification through physical arousal.

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**C. DIJKERMAN, M. WEBELING, M.J.E. VAN ZANDVOORT, J.M. TER WAL, & E. GROET. A Long-Lasting Reduction of Somatosensory Deficits After Prism Adaptation in a Neglect Patient.**

Neglect is a supramodal syndrome that can affect motor and/or somatosensory function in addition to visuospatial processes. Previous studies found that basic somatosensory deficits in neglect patients can be temporarily reduced by sensory manipulations such as vestibular stimulation. In recent studies, visuomotor adaptation to rightward displacing prisms has been found to improve several neglect symptoms, including those that pertain haptic spatial representations. Furthermore, the effects of prism adaptation (PA) appear to be relatively long lasting. The current study involved a 31-year old lady (KP) with a large infarct in the territory of the middle cerebral artery. At four months post-stroke she had a hypertonic paralysis and dysesthesia of her left arm and leg, and hemispatial neglect. After PA, a reduction in contralesional somatosensory deficits was found for pressure sensitivity (von Frey hairs aesthesiometer) and passive joint movement sense compared to three baseline assessments. One and three weeks after prism adaptation, a sustained improvement in somatosensory performance was observed. PA was performed a second time to confirm these findings, three weeks after the first PA. Again a significant decrease in deficits was found for both somatosensory tasks. This study suggests that PA reduces basic non-spatial somatosensory deficits in a neglect pa-

tient, and that this effect can last up to three weeks. The findings, therefore suggest that PA influences higher order, supramodal representations.

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#### **F. DOMAHS & M. DELAZER. Rehabilitation of Multiplication Facts: A Single Case Study.**

We describe the case of a 38 years old man who suffered from a left frontal contusion, due to traumatic brain injury. Three years after this accident, he—amongst others—presented with a remarkable delay in retrieving multiplication facts, resulting in a severe handicap at his job. However, accuracy was only slightly reduced in this task. The patient underwent a rehabilitation program, aimed at reinforcing automatic retrieval of multiplication facts. A vanishing cue method was applied, in which coloured presentation of the problem was related to some aspect of the result. This functional therapy lead to progressive improvements during 20 sessions which were not due to increased alertness. In an experimental task it could be demonstrated that the patient had, in fact, automatic access to multiplication problems. Importantly, coloured presentation of the task helped to reduce response latencies. Gains of the training generalised to non-trained problems, to the non-trained presentation format of the trained problems, and to non-trained multiplication ties. However, there was no generalisation to rule based multiplication problems. Preliminary evidence shows that the described rehabilitation effects are long-lasting. The results are discussed in the light of different remediation strategies described in the literature.

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#### **S. GLATZL, T. BERGER, M. VETTORI, M. DELAZER, & T. BENKE. Neuropsychological Rehabilitation of Patients With Multiple Sclerosis.**

Multiple sclerosis frequently leads to impairments in cognitive functions, such as memory deficits, attentional deficits or lack of mental flexibility. Though training programs for neurological patients concerning memory, attention and problem solving have been repeatedly described, specific programs are needed for MS patients. The present therapy study investigates the effect of cognitive training as compared to a combination of relaxation training and training of coping strategies. Training was carried out in two groups ( $n = 8$ ,  $n = 7$ ) of MS out-patients. Training was divided into two periods (each comprising of 12 units). Group A focused on cognitive training in the first period, on relaxation and coping strategies in the second. Group B performed the training in reversed order. Neuropsychological assessment was performed before training, after the first period and after end of the training. Significant improvements were achieved in both training periods and with both groups. Thus, a specific effect of purely cognitive training was not found. Instead, both training methods (cognitive and combination of relaxation, & coping strategies) led to both subjective and objectively measurable improvements. Neuro-psychological improvements were found in verbal learning and memory, in divided attention and in verbal fluency. Importantly, patients themselves rated the training as successful. However, main subjective improvements did not regard cognitive functions (43% report better every-day memory performance), but social abilities and coping (63%). Overall, 77% of the patients reported an improved life quality after training.

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#### **J. HINOJOSA, I. MORENO-TORRES, & M.L. BERTHIER. Multimodality Therapy for Word Meaning Deafness.**

Patients with word meaning deafness (WMD) fail to understand the meaning of spoken words that they can understand when read. WMD is currently conceptualised as an “access disorder” because the transmission between intact auditory input lexicon and semantic system is impaired. While it has been suggested that access disorders should be treated by attempting to improve the abnormal auditory modality, Francis et al. (2001)

reported improvement of WMD in a single patient using both visual and auditory modalities of treatment. We report the effects of cognitive rehabilitation in a 42 year-old woman with chronic post-stroke WMD. Language evaluation at baseline revealed fluent and empty spontaneous speech contaminated with semantic paraphasias. She showed normal phonemic discrimination for words (51/56) and nonwords (52/56) and auditory lexical decision (165/180). While on oral word-picture match (within category condition) her performance was 153/200, she did considerably better on visual word-picture match (178/200). The patient was initially treated using completion exercises which proved to be ineffective to improve auditory comprehension and naming after one month of intensive therapy. She was then treated using exercises of identification of semantic relations through oral reading (superordinate/subordinate, hyponymy, part-of relation, similarity of meaning and associative relations) (Nuebert et al., 1998) 3 hours/wk during 6 wks. We found a considerable improvement not only on visual and auditory modalities (oral word-picture match: 181/200; visual word-picture match: 189/200), but also in oral naming (baseline EPLA 52: 20/60; post-therapy EPLA 52: 37/60). Our findings confirm previous observations that multimodality therapy is useful in ameliorating WMD.

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#### **E. HÖFLER-WEBER & B. PREILOWSKI. Training Bimanual Coordination in Children: Attentional and Sensory Motor Factors.**

Differences in bimanual coordination skills among children during development are often explained in terms of differences in maturation of the sensory motor system, as indicated, for example, by the persistence of involuntary contralateral co-activation during uni-manual movements (interlimb coupling). The present study attempted to investigate the influence of training on bimanual coordination in two groups of 5 to 6 and 7 to 8-year old children ( $n = 34$ ). The training involved six weekly sessions using the Bimanual Coordination Test (BCT), which requires continuous rotatory movements with both hands. Several combinations of parallel *versus* symmetric movements as well as equal *versus* unequal left-to-right inputs were trained. The status of neuromotor maturation and measures of basic right and left hand motor functions were obtained. The children also performed a test of divided attention. In comparison with a waiting group, all participants increased their performance on the BCT significantly and in a 4-week follow-up held that level of performance. Also there was positive transfer to BCT-tasks which had not been used during training. The younger children showed greater improvements than the older ones. Most prominent were a reduction in the variability of performance and in associated movements of the contralateral limb. A regression analysis indicated that divided attention performance had the highest predictive value for BCT-performance before training. Other predictors were level of associated movements and level of right—as well as left—hand skill. After training the age of the children as well as basic sensory motor functions had highest predictive values.

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#### **S. KAMPING, C. BREITENSTEIN, A. JANSEN, & S. KNECHT. Word Learning Can Be Achieved Through Intense Frequency of Exposure.**

The present study examined if conscious awareness is necessary for novel word learning, or if intense frequency of exposure is sufficient. We trained 38 subjects in a pseudoword learning task (cf., Breitenstein & Knecht, 2002). Over the course of five training sessions, subjects learned which picture is correctly coupled with a given pseudoword. The learning principle is higher co-occurrence of “correct” as compared to “incorrect” pairings (ratio of 4:2 in the first training session increases to a ratio of 20:2 at the end of the fifth session). Subjects were divided into two conditions: (a) “implicit learning” ( $n = 19$ ) and (b) learning with “conscious awareness” ( $n = 19$ ). The “conscious awareness” group was provided with visual feedback (smiley for correct, whiney face for incorrect responses) immediately after responding. Subjects were naïve to the learning principle. About one week, and approximately one and two months post train-

ing, subjects returned for additional sessions to examine long-term retention effects. Both groups successfully acquired the vocabulary. Repeated exposure increased the accuracy of correct word-object-pairings to approximately 90% in all subjects. The learning curve was steeper in the "conscious awareness" group compared to the "implicit" group. Thus, conscious awareness led to a slight initial acceleration of learning but did not improve latency to peak performance or long-term retention of lexical knowledge. These findings (a) provide a strong indication that word learning is not dependent on conscious awareness and (b) imply that aphasia treatment approaches, which do not rely on conscious awareness, may yield favorable outcomes.

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#### **H. KULKE, S. ROEHRING, W. SCHUPP, & U. REULBACH. Restitution-Oriented Training of Attentional Disorders in a Chronic Stage—Does it Make Sense?**

The time period when restitution-oriented treatment of neuropsychological disorders is considered to be really effective is limited to several months after brain lesion. Further treatment concentrates mainly on helping compensatory and adaption processes, as continued training sessions include the risk of preventing impairment acceptance, with rather negative effects on social reintegration. Despite this widely accepted opinion there may be an indication of repeating training processes in later stages of recovery, considering the fact that because of cost-bearer treatment restrictions the restitution potential is rarely exploited completely in the early stages. In an evaluation study we treated a sample of 48 patients (Range 18–70 years, median 53.50 years, female 18, male 30) over a period of 11 weeks. The treatment paradigm combined outpatient neuropsychological therapy (usually once a week) with the possibility of computer-based training daily at home under supervised conditions. To avoid spontaneous recovery effects the elapsed time since lesion varied between 5 and 60 months with a median of 26 months. We acquired part of the patients among our former inpatient clientele, others were found by advertisement in regional newspapers. We built up matched pairs (age, gender, type of lesion, elapsed time) and assigned them to two different training groups, named "spring-group" and "autumn-group" after their specific training period, the latter serving as a control group for the spring group before their own treatment. Our results show significant progress in several attention parameters even years after brain lesion, encouraging attempts of well-timed booster sessions in later stages of recovery.

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#### **S. LACHER, B. STEMMER, T. LEIM, & P.W. SCHÖNLE. Course of Behavioral-Cognitive Status in Working and Non-Working Stroke Patients.**

The objective of our study was to compare the course of the behavioral and cognitive status at different times during the rehabilitation process in non-aphasic stroke patients who were professionally engaged and those who were not at 12 months after discharge. Using behavioral and cognitive scales, we investigated 144 first time non-aphasic stroke patients at the time of admission to neurological rehabilitation and 12 months after discharge. The results of the assessments were statistically compared between groups (working vs. non-working patients) and within groups (development over time) at the time of admission and discharge. At the time of admission a between group comparison showed that compared to the working group the non-working group obtained significantly worse scores in all scales. There was one exception: both groups did not differ on a scale representing emotional aspects. The within group comparison revealed that both groups improved significantly over time in all functional scales. Again, there was one exception: whereas the working group also improved on scales representing emotional aspects, the non-working group did not. Although the non-working group were generally more impaired

on behavioral and cognitive measures, similarly to the working group they showed dynamic improvement over time in nearly all behavioral and cognitive functions. It was only the emotional aspects that did not improve over time. This suggests that the emotional aspect may be a decisive factor for vocational rehabilitation in non-aphasic stroke patients.

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#### **R.F. MENESES, J.L. RIBEIRO, A. MARTINS DA SILVA, & A.R. GIOVAGNOLI. Research, Rehabilitation, and Ethics.**

Based on methodological issues, comorbidity is usually an exclusion criterion in Health Psychology. This has ethical implications: by excluding individuals with comorbidity from research, scientists are limiting their work and the literature that could support intervention programs among these individuals. The aim of the present study was to compare the Quality of Life (QoL) of individuals with Epilepsy with that of individuals with Epilepsy and some other pathology, considering also the use of medication other than for Epilepsy. Seventy-five individuals with Partial Epilepsy (40 women) were assessed by means of the SF-36, ESI-55 Cognitive Function Scale, a Seizure Control Scale based on the Liverpool Seizure Severity Scale, and the Hospital Anxiety and Depression Scale. Twenty-one reported some other pathology, and 12 were using medication other than for epilepsy. Individuals with comorbidity reported a significantly worse QoL in every SF-36 scale, and significantly more anxiety and depression than individuals with Epilepsy only. Additionally, individuals taking medication other than antiepileptic drugs (AED) reported a significantly worse QoL in comparison with individuals taking only AED in terms of SF-36 Physical Function, Pain, General Health, Vitality, and Mental Health scales and in the Cognitive Function Scale; they also reported significantly more anxiety and depression. These results stress the need to consider individuals with Epilepsy and comorbidity and/or polytherapy as a priority in Health Psychology research, namely in terms of QoL, Negative Affectivity, and Cognitive Function (perception and performance). If our results are systematically replicated, interventions, namely cognitive rehabilitation and psychotherapy, are necessary. GRANT PRAXIS XXI/BD/18536/98 by FCT.

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#### **K. MICHIELS, C. KIEKENS, H. MACHIELS, K. BEECKMANS, & R. LYSSENS. European Psycho-Pedagogical Assistance Network for Patients With Acquired Brain Damage.**

The European Psycho-Pedagogical Assistance Network (Europanet) is a system for telerehabilitation in patients with acquired brain damage. Fifteen patients with a traumatic brain injury ( $n = 3$ ) or stroke ( $n = 12$ ) received (neuro)psychological and medical interventions with Europanet. These patients had already followed a multidisciplinary rehabilitation program. During 4 months the patient and family members were able to have contact at home with a neuropsychologist, an occupational therapist or a psychiatrist by means of a personal computer with an E-mail system (on a regularly basis) and a videoconference kit. A videoconference was held between the team, the patient and/or a family member during a weekly session of one hour. This procedure gave the team the opportunity to provide professional care consisting of psychotherapy, teaching compensation strategies to cope with cognitive and motor disabilities or giving medical advice. All patients filled out three questionnaires (Health Survey (SF 36), Sickness Impact Profile (SIP 68) and Symptom Checklist (SCL-90)) to evaluate psycho-emotional functioning before and after treatment. A matched control group, consisting of 15 patients with acquired brain damage, received no treatment during the study period. After treatment with Europanet, a significant improvement was seen for the scale 'emotional stability' (SIP 68) and the scales 'anxiety', 'interpersonal sensitivity' and 'psychoneuroticism' (SCL 90) in our patients. The control group showed no statistical improvement on any scale of the administered



tests. In conclusion we can state that telerehabilitation has a positive effect on psycho-emotional functioning in patients with acquired brain damage. Correspondence: *K. Michiels, Department of Physical Medicine and Rehabilitation, UZ Pellenberg, KU Leuven, Weligerveld 1, 3212 Pellenberg, Belgium. E-mail: karla.michiels@uz.kuleuven.ac.be*

**C. ROHDE, A. LUMSDEN, & M. McQUILLAN. The Impact of Neuropsychological Assessment on Family Systems Therapy.**

When families with a known brain injured member are referred for systemic family therapy, the dominant social discourse ensures that problems of performance, relationships and role fulfilment are understood in terms of past history rather than as a consequence of neurological impairment. In this pilot study of five families a thorough neuropsychological assessment was completed at the beginning of therapy. An initial interview was conducted with each family in order to assess family functioning including role competence and adaptability. The results of the neuropsychological assessment were then explained to the whole family with an emphasis on implication for functioning within the specific family context. Subsequent family therapy sessions were observed in order to monitor the frequency with which family member's explanation of events reflected an understanding of the identified cognitive deficits rather than placing blame on more generic factors. It was hypothesized that those families who successfully integrated the neuropsychological information in a way that enabled individual and family functioning to be reframed in terms of the brain injury made better adjustments to the disability.

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**S. SILVA & M. GUERRIERO. Burden in Caregivers of AD and ALS Patients.**

**Objectives:** The purpose of this study is to assess the satisfaction and burden among caregivers of Alzheimer's disease (AD) patients, compared with those who care for dependent but cognitively intact patients with other progressive neurodegenerative diseases. **Method:** Caregivers of AD patients ( $n = 24$ ) were compared with two other groups: a control group ( $n = 31$ ) and a group of Amyotrophic Lateral Sclerosis (ALS) patient caregivers ( $N = 11$ ). All subjects completed a questionnaire of demographic data; the Mini Mental State Examination (MMSE); the Blessed Dementia Scale (BDS) to assess dementia severity; the Satisfaction With Life Scale (SWLS), and a scale assessing depression, anxiety and stress levels (Depression Anxiety Stress Scale—DASS). **Results:** The burden in caregivers of AD and ALS patients was found in several measures. When compared with the control group, the two caregiver groups showed increased levels of depression, anxiety and stress, and lower levels of satisfaction with life. There were no significant differences between the two caregiver groups in those domains. Cognitive impairment did not seem to increase the burden in any of the measures considered. The degenerative nature of these diseases may justify this pattern of results.

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**N. STADIE & U. KRÜGER. Acquired Dysgraphia: Replication of a Therapy Study on Developmental Dysgraphia.**

This study examines the rehabilitation of writing in a 53 year old patient with acquired surface dysgraphia following tumor removal. Writing deficits affected wordfinal consonants due to devoicing in German (e.g., di:p à DIEB (thief); plump à PLUMP (clumsily)) revealing a nonlexical writing strategy. In an intervention study with a similar case due to developmental impairments, two lexically-based methods were evaluated (Stadie & Martin, 2000), showing significant treatment and generalization effects for the rule-based morphological method in contrast to whole word treatment. A re-evaluation applying the same therapy methods was conducted with an

individual with acquired dysgraphia. Method 1 focussed on the re-establishment of visual information of whole word forms. Writing to dictation and delayed copying were used to strengthen graphemic representations. Method 2 used morphological information such as pluralization or comparison in order to disambiguate wordfinal consonant neutralization of the monomorphemic targets. A cross-over item-specific design with multiple baselines was administered. Following results of the developmental study, we predicted a method specific effect in favor of the rule-based method for trained and untrained items. In order to strengthen this prediction, we additionally administered writing to dictation with and without articulatory suppression in the baselines, assuming an influence of subvocal articulation only for the rule-based writing strategy. Results will be presented and discussed with reference to the relative impact of replicating therapy studies administered either to developmental and/or acquired spelling disorders.

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**Plenary Session 5/10:15–11:00 a.m.**

**THE NEUROPSYCHOLOGY OF NOUN CLASSES**

**Carlo Semenza**

**Paper Session 9/10:15–11:00 a.m.**

**MALINGERING**

**D.G. ANDREWES, J. FOSTER, K. SMITH, & R. HUNTER. Malinger Within the Medico-Legal Context: Malingering and Simulation.**

There is the tacit assumption that patients are detected to be either malingering, or not malingering, within a simplistic dichotomy. However, evidence allows that patients with and without brain damage may exaggerate impaired performance to varying degrees with varied motivations. Also, some patients may take on a "sick role" in which the impaired simulation is presented to the client's family as well as the examiner. Case material is presented to support the differential diagnosis of malingering and simulation, which questions Freud's theory of repression. A study is also reported which used controls ( $n = 20$ ) and brain damaged patients ( $n = 10$ ) who were required to simulate malingering and who were compared with controls ( $n = 20$ ) and brain-damaged patients ( $n = 10$ ) who were required to do their best. Subjects were assessed on the new Royal Melbourne Malingering Association Test (RMMAT) and the Recognition Memory Tests for Words and Faces (Warrington, 1984). Both groups showed a significant difference between simulation and non-simulation conditions. Sensitivity *versus* specificity ratings were respectable and are discussed in terms of the ethical demands of the tests. The different reported strategies of simulation are discussed in the context medico legal reports.

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**R. SCHLESINGER. The Structured Clinical Neuropsychological Interview.**

The expert clinical neuropsychological evaluation has a unique role to play in the head injury litigation process. Though the clinical neuropsychologist is but one among many experts who can contribute to the evaluation of damages from traumatic head injury, the specialisation of the neuropsychologist in thoroughly evaluating the overall "higher" brain functions sets this expert apart from the others. In most traumatic head injury cases, it is the impairment of such higher cerebral processes as attention, concentration, memory, language processes, complex thinking, emotional expression, and personality structure that constitute the bulk of the actual damages resulting from the injury. Though physicians such as psychiatrists,

neurologists, and psychiatrists can evaluate medical and physical deficits in detail, their examinations of complex higher cerebral processes are relatively cursory and brief—sometimes lasting only a few minutes or so. In most head injury cases, this short assessment of higher cerebral functions is not adequate for a comprehensive evaluation of the deficits that must be interpreted as problems in activities of daily living and psychosocial adjustment. The neuropsychologist will measure the same higher functions as the above physicians but much more extensively and in minute detail over six to ten hours with tests that are normed, standardised, and comprehensive in scope. This more comprehensive evaluation provides significantly more information about the higher cerebral functions and is critical in helping to ascertain the actual level of damages from traumatic head injury. Some of the following items form the essence of the structure of the Neuropsychological Interview: Olfactory Hallucinations; Odour Discrimination; Word Finding Difficulty; Urinary/Fecal Incontinence, Sexual Disorders, Episodic Tinnitus, Mental Decline, et al.

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**D. NEMETH, T. JENNINGS, M. SCHEXNAYDER, K. WALTERS, J. VAN HOOK, J. HAMILTON, J. ARRINGTON, & K. GEIGER.**  
**Gender Influence on Clinical Course of Treatment for Brain Injury Litigants.**

Three women and three men who experienced brain injuries resulting from motor vehicle accidents (MVAs) displayed similar sequelae upon medical presentation. Yet physicians initially determined an affective etiology for the women's symptomatology (e.g., chronic headaches, dizziness, and nausea), whereas the men initially received cognitive diagnoses for the same brain-behavior or similar symptoms. Neuropsychological evaluation revealed brain-behavior dysfunction involving the temporoparietal regions for all six patients, with some having more diffuse injuries. As the women's affective presentations were primarily sad and tearful, they were diagnosed with depression by their attending physicians, were typically treated psychopharmacologically, and were offered follow-up care rather than aggressive intervention. In contrast, the men, who presented more stoically, were perceived as primarily suffering from cognitive problems, and received more aggressive treatment for their brain-behavior dysfunctions, including medication, psychotherapy, and/or in/outpatient rehabilitation. It is not uncommon for women to present to their medical practitioners in affective crisis secondary to MVA trauma, and for men to present more stoically. It is, therefore, hypothesized that gender presentation may, at times, preclude appropriate and timely intervention.

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**Birch Lecture/11:15 a.m.–12:00 p.m.**

**BODY REPRESENTATIONS: EVIDENCE FOR  
DISTINCT TYPES OF BODY KNOWLEDGE**

**H. Branch Coslett**

**Paper Session 10/11:15 a.m.–12:00 p.m.**

**NEUROPSYCHOLOGY OF EMOTION**

**M. MILDERS, M. IETSWAART, J.R. CRAWFORD, & D. CURRIE.**  
**Recognition of Emotional Expressions in Patients With Traumatic Brain Injury.**

Despite the current interest in recognition of emotional expressions in clinical populations, remarkably few studies have examined expression recognition in patients with traumatic brain injury (TBI). Investigating this ability in patients with TBI is of interest for at least two reasons. First,

impairments in recognising the emotional state of other people may underlie some of problems in social relationships often seen in patients with TBI. Second, more knowledge about which emotions are particularly impaired in TBI patients is relevant for the debate about selective impairments in emotion recognition and whether these reflect damage to brain mechanisms for specific emotions. The aim of this study was to address these two issues. We tested patients with TBI, orthopaedic control patients and healthy controls on their recognition of emotions expressed in the face and the voice, using discrimination and naming tasks. Recognition scores of the TBI group were poorer than those of the two control groups. Control tasks showed that these impairments were unlikely to result from general perceptual deficits. Impairments in emotion recognition were not strongly associated with problems in social behaviour in TBI patients. The TBI group appeared most severely impaired at recognising expressions of fear, both in the face and the voice. Differential impairments in recognising fear have been reported in patients with brain damage from other causes than TBI. This impairment has been presented as evidence for a specialised brain mechanism for fear. An alternative interpretation, more in line with our findings, is that it reflects task difficulty.

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**K. WANG, R. HOOSAIN, L. SHEN, C. WANG, Y. MENG, & R. YANG.**  
**Neural Basis of Perception of Basic Emotional Expressions: Particularly for Fear and Disgust.**

The present study addresses questions about whether the Chinese perceive the six basic emotional expressions in a categorical manner, whether they perceive disgust, which is included in the Chinese “seven emotions”, as a distinctive emotion, and the neural basis for processing fear and disgust expressions. A labeling task, with 30 morphed emotional faces across happiness-surprise-fear-sadness-disgust-anger-happiness, measured the ability to recognize a six-basic-emotion continuum. Firstly, the identification frequency curves for 71 normal Chinese showed six discrete peaks for the emotions (including disgust) and abrupt shifts near each of the mid-point morphs between emotions. The preliminary results here support that Chinese perceive the six emotions in a categorical manner, and disgust is a recognized basic emotion. Secondly, LJM, a schizophrenic patient with bilateral anterior cingulate gyrus lesions and a very small lesion in the right amygdala, manifested a robust deficit in recognition of fearful expression sparing other emotions. We hypothesized that bilateral amygdala and cingulate gyrus are all selectively involved in fear processing (in parallel or at different levels). Lastly, six Huntington's disease and 32 Huntington's disease (both mainly involved basal ganglia) patients showed severe impairment in processing of disgust, sparing other emotions. This result suggested that basal ganglia have a crucial role in disgust processing. The result of LJM and WD or HD demonstrated a double dissociation between fear and disgust, which in turn supports that the brain has discrete substrates for processing of different basic emotions, at least for fear and disgust.

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**D.G. ANDREWES & P. HARDY.** **Emotional Dysfunction and Multiple Sclerosis.**

Emotional and social dysfunction has been empirically associated with multiple sclerosis (MS) in terms of increased depression and euphoria. However, these results are associated with self ratings on questionnaires designed for psychiatric populations using a limited assessment of dysfunction. This study used the Emotional Dysfunction Questionnaire (ESDQ) (Andrewes et al. in press) to assess 60 patients and matched controls compared with 19 controls on Partner Rated and Self Rated versions of the ESDQ. Partner ratings showed significantly higher ratings on the Anger, Emotional Dyscontrol, Fatigue and Indifference scales when compared to controls. Self ratings: Partner ratings showed significantly more Anger,

Helplessness (Depression/Anxiety), Indifference, Lack of Insight and Fatigue. High ratings of Anger and Fatigue show that this may be a relatively more important issue to carers and patients on this rating scale based on a perceived problem rating. It is possible that the indifference and lack of insight rated here has been reported elsewhere as Euphoria. These results suggest a new approach to therapeutic intervention with these patients

which may include a cognitive behavioural approach such as anger control. The results are also discussed in terms of a model of emotional dysfunction (Andrewes, 2001).

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## Friday Afternoon, July 18, 2003

### Poster Session 4/1:00–6:30 p.m.

#### CHILD NEUROPSYCHOLOGY

##### **A. BLENDER, M. WANNKE, & B. PREILOWSKI. Neuropsychological Profiles of Children With Specific Learning Disabilities.**

In order to contrast neuropsychological profiles of children with difficulties in reading, spelling and arithmetic, three groups of 8–10 year old German school children were studied. The groups were formed using standardized tests of IQ, reading, spelling and arithmetic: The make-up of two disability groups reflects the level of comorbidity of dyslexia and spelling problems (40%) as well as dyscalculia and reading and/or spelling difficulties (25%) in referrals by the schools for suspected scholastic disabilities: Thus Group 1 (Dyslexia Group) consisted of 29 children with developmental dyslexia (F81.0) or specific spelling disorder (F81.1). Group 2 (Dyscalculia Group, F81.2) included 10 children. A third group consisted of children matched for age, sex, and IQ to those of the two disability groups. The profiles were constructed using the NEPSY, a developmental neuropsychological instrument consisting of 26 tests describing five functional domains. With the exception of sensorimotor functions, the disability groups differed significantly from the controls. Both showed deficits in the domains Attention/Executive Functions, Language, Visuo-spatial Processing and Learning/Memory. However, the Dyscalculia Group scored lower in fewer of the subtests of these domains than the Dyslexia Group. A component analysis showed subtests of the language domain as well as auditory attention and narrative memory to be most sensitive predictors of reading and/or spelling disabilities. For dyscalculic problems verbal fluency, design fluency, auditory attention, arrows and memory for names had high predictive validity. Thus there is evidence of a similar nature of distinct cognitive impairments in children with mathematical and reading and/or spelling disabilities.

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##### **A.I. BUIZER, L.M.J. DE SONNEVILLE, & A.J.P. VEERMAN. Visuo-Motor Control and Executive Function in Survivors of Childhood Leukaemia Diagnosed at a Young Age.**

Acute lymphoblastic leukaemia (ALL) is the most common form of childhood cancer. With improving treatment, long-term survival figures have increased to 70–80%. Prophylactic CNS treatment is essential to prevent CNS relapse. Cranial irradiation (CI) has been found to cause cognitive decline. Since 1984, Dutch treatment protocols use CNS chemotherapy (CNS-CT: methotrexate, cytarabine, steroid) instead. There is no consensus on the long-term neuropsychological effects of CNS-CT. In most studies comparing CNS-CT to CI, CNS-CT is found to be a more benign treatment. Studies focusing on CNS-CT, using a good control group, however, are few and results vary. Young children are thought to be most vulnerable to toxic insult, and damage to cerebellar-frontal systems may be involved. This would result in deficits in visuo-motor control and executive function. This study examines performance of 20 ALL survivors diagnosed before the age of 5, compared to 43 healthy controls on three visuo-motor tasks and on an executive function task. The ALL survivor group showed normal reaction times on a simple baseline speed task. The

accuracy on a tracking task, measuring motor control of a predictable movement was also similar to controls. However, on a pursuit task, measuring motor control that requires concurrent planning and execution of unpredictable movements, the ALL survivors performed significantly worse compared to controls. In an executive function task, measuring attentional flexibility, the ALL survivor group showed a strong trend to perform worse than controls. These results suggest that in young children treated for ALL with CNS-CT, late effects may occur in the domains of higher level visuo-motor control and executive function.

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##### **H. CLEAVINGER, J. SAYER, S. RICE, W. McMAHON, J. LAINHART, & E.D. BIGLER. Volumetric Analysis of the Mesencephalon and Metencephalon in Autism With Macrocephaly.**

**Background and Objectives:** Some speculation has been made implicating an association of mesencephalic and metencephalic abnormalities with autism; however, not all neuroimaging studies have demonstrated the presence of volumetric differences. One reason for the lack of consistent findings has been a failure to control for the increased prevalence of macrocephaly as well as mental retardation found in autism. **Methods:** In the current study, controlling for age, head size and level of mental retardation, we examined the pons, medulla, midbrain, and total brainstem. Five groups were examined: an autistic normocephalic group ( $N = 30$ ), a comparison normocephalic group ( $N = 16$ ), an autistic macrocephalic group ( $N = 15$ ), a comparison benign macrocephalic group ( $N = 9$ ), and an autistic group with mental retardation ( $N = 4$ ). The brainstem was volumetrically examined using MR scans for all 74 subjects. The areas of measurement included left, right, and total brainstem, midbrain, medulla, and pons. Intra- and interrater reliabilities were assessed ( $r = .90$ ) and quantitative analyses performed by two independent raters following an established protocol. **Results:** Significant differences in the various brainstem measures were found when the macrocephalic groups were compared with normocephalic groups. However, when controlling for head size, no significant differences were found in total brainstem, midbrain, medulla, and pons between autism and control subjects. Autism subjects with mental retardation did not significantly differ from the other autism subjects or controls. **Conclusions:** Controlling for head size, no differences between autism and control subjects were found between total brainstem volume, pons, medulla or midbrain. The potential functional organization of these regions and their potential role in autism will be discussed.

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##### **P.K. CZAPINSKI & M.L. STEWART. Patterns of Memory Performance in Children With Traumatic Brain Injury.**

One of the recently developed instruments designed to assess memory abilities in children is the Children's Memory Scale (CMS) (Cohen, 1997). To date, no study has explored the performance of children with varying degrees of traumatic brain injury (TBI) on the CMS. The main purpose of the present investigation was to examine memory functioning outcomes



on the CMS in children (aged 9–16 years) with moderate and severe TBI who had undergone neuropsychological testing during the rehabilitation phase of their recovery. The children were classified into severity groups based on their lowest recorded Glasgow Coma Scale scores and results of CT and MRI scans. First, children with moderate and severe brain injury were compared to the normative sample of the CMS. The results revealed that compared to normative data, children with severe TBI had significantly reduced scores on the Immediate Visual, Delayed Visual, Immediate Verbal, Delayed Verbal, Learning, and General Indices. In contrast, there was no difference in performance between children with moderate brain injury and the normative sample of the CMS. In the second part, children with moderate brain injury were compared to children with severe brain injury. Children with severe brain injury had significantly more difficulty than those with moderate brain injury on the Attention/Concentration, Delayed Visual, Immediate Verbal, Delayed Verbal, and General Indices. These results highlight the differential patterns of memory performance exhibited by children with varying degrees of brain injury impairment. The findings underscore the clinical utility of the CMS in the context of neuropsychological assessment.

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### **S. KISELEV. Individual Differences in the Information Processing Speed and Brain Organization in Preschool Children.**

The aim of this study was to examine a possible relation between the speed of information processing and individual differences of brain organization in preschool children. The speed of information processing was measured in 34 children at 6–7 years with the computerized technique, developed by the author (Kiselev S., Lupandin V. Computerized Technique for investigation of temporal Characteristics of Sensorimotor Reactions in Preschool and First-Grade School Children, *Journal of High Nervous Activity*, 2001, No. 2). The individual differences of brain organization were investigated with the child neuropsychological technique, developed by T.V. Ahutina in Moscow State University. This technique allows to establish the preferred development of left or right-hemisphere function in children. We used the *U* test Mann-Whitney. Children with preferred development of right-hemisphere and left-hemisphere function had the differences in level of performance of some sensorimotor reactions. In particularly the “right-hemisphere” children were more successful in performance of the differential reactions on stimulus, which differed only on orientation. At the same time the “left-hemisphere” children were more successful in performance of the differential reactions on stimulus, which differed only on color. We have not found out the distinctions between these groups on simple reaction.

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### **S. ALECU DE FLERS, J. KITTEL, K. KONRAD, M. BRAUN, S. GAUGGEL, & A.M. JACOBS. Phonological Deficits in Children With Dyslexia and/or ADHD.**

Although reading disabilities (RD) and attention deficit/hyperactivity disorder (ADHD) co-occur at a rate greater than expected by chance, the nature of association between those childhood disorders is still unknown. To address the phenocopy *versus* etiological subtype hypothesis, phonological impairments were investigated by a computerized reading task. A sample of 18 children with ADHD-only, 23 children with ADHD+RD, 21 children with RD-only and 34 control children aged between 8 and 12 years were tested with monosyllabic words and pseudowords. Both dyslexic groups (RD-only, ADHD+RD) showed severe deficits in non-word reading and differed highly significantly from the ADHD-only and the control group. Thus, phonological impairments seem to be a unique cognitive marker for RD, but not present in children with ADHD. These results support true comorbidity for the group of children with both, ADHD and RD.

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### **K.W. LANGE & O. TUCHA. Effects of Methylphenidate on Kinematic Aspects of Handwriting in Children With ADHD.**

Poor handwriting in hyperactive children often contributes to academic failure. Beneficial effects of methylphenidate on the quality of handwriting have been shown. Using a digitizing tablet, the handwriting of 21 hyperactive boys was examined both during methylphenidate treatment and following withdrawal of the drug. Half of the hyperactive boys were tested first on methylphenidate and then following withdrawal of the drug and the remaining hyperactive boys were examined in the reverse order. Twenty-one control boys underwent the same examination. Velocity and acceleration of handwriting movements were measured. Furthermore, every writing specimen was independently rated by four examiners regarding the quality of handwriting. Following withdrawal of the drug, the quality of handwriting specimens of hyperactive boys was poorer than during treatment with methylphenidate. Statistical comparison of writing movements of hyperactive boys on and off methylphenidate revealed that the medication resulted in a deterioration in handwriting fluency. The results showed that following withdrawal of medication, hyperactive children did not differ from control boys in handwriting movements. The improvement in hyperactive behaviour through methylphenidate was associated with increased legibility and greater accuracy of handwriting. The intention to write neatly may interfere with the fluent writing process.

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### **A. NARBERHAUS, K. VERGER, D. SEGARRA, J.M. SERRA, P. SALGADO-PINEDA, F. BARTUMEUS, & J.M. MERCADER. Corpus Callosum Surface and Cognitive Sequelae in Paediatric Closed Head Injury.**

Diffuse traumatic brain injury (TBI) in children is the responsible for persistent neuropsychological sequelae and is probably related to academic limitations of these patients. Magnetic Resonance (MR) morphometric analysis allows in vivo determination of different cerebral atrophic parameters. Volume of cerebrospinal fluid (CSF) spaces, corpus callosum, hippocampus, and basal ganglia have been reported as structures that can reflect the neurocognitive status. We selected 15 closed-head-injured children and adolescents following paediatric moderate-to-severe TBI without focal lesion, or in case of having suffered focal lesion, smaller than 2600mm. These subjects were examined by means of neuropsychological tests and morphometric analysis at least 6 years after injury, and were matched with a control group. Starting from a neuropsychological battery, that included tests of intellectual, memory, frontal lobe and motor speed functioning, we calculated the global score of neuropsychological impairment. Although the results demonstrate significant differences in surface area measurements of all the analyzed structures, only atrophy of the corpus callosum significantly explained the global neuropsychological score ( $p = .033$ ). This study shows how diffuse damage caused by moderate-to-severe paediatric TBI has long term effects on several cerebral structures and on cognitive functioning. Corpus callosum atrophy is the best measure to predict neuropsychological sequelae.

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### **D. NEMETH, K. WALTERS, J. VAN HOOK, T. JENNINGS, J. HAMILTON, J. ARRINGTON, & K. GEIGER. Processing Speed Versus Working Memory Problems in ADHD Children.**

Five children diagnosed with Attention Deficit Hyperactivity Disorder (ADHD) were given Comprehensive Psychoeducational Evaluations. All exhibited impaired performances on the Test of Variables of Attention (TOVA). On the Marching Test, each child had difficulty following the examiner's tempo and tended to jump ahead. On the Wechsler Intelligence Scale for Children—Third Edition (WISC-III), two of the children exhibited difficulties in Processing Speed, whereas the others exhibited Working Memory/Freedom From Distractibility problems. On the Palos Parent/Teacher Questionnaire, children with Processing Speed difficulties pre-

sented primarily with behavioral problems (e.g., hyperactivity). Whereas, children with Working Memory difficulties often presented with affective problems (e.g., hypoactivity). Both groups of children presented with learning problems. To be effective, interventions (e.g., psychopharmacological and educational) must take into account these differences.

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#### **S. RICE, E.D. BIGLER, J. LAINHART, & W. McMAHON. Corpus Callosal Differences in Autism.**

Some differences in corpus callosum (CC) surface area in autism have been reported. However, past research has been confounded by two factors, increased prevalence of mental retardation (MR) and macrocephaly in autism. In the current study we examined CC surface area in autism subjects with MR as well as those with normal IQ (NIQ) including autism subjects with macrocephaly. Surface area measurements of the midsagittal area of the CC were based on MRI scans from 9 autistic MR, 42 autistic NIQ, and 59 control subjects using the Witelson protocol. The Witelson protocol permits standardized examination of specific regions of the CC such as the genu, isthmus, and splenium. Autistic subjects met ADI-R, ADOS-G, and DSM-IV criteria for autism. Intellectual abilities were measured with the WAIS-III or WISC-III. There was a significant size difference in the genu between autistic MR, autistic NIQ, and controls when head size and age differences were controlled ( $f = 3.579, p < .05$ ). There were also differences between autistic NIQ and controls at the level of the genu ( $f = 6.037, p < .05$ ). Other comparisons did not yield significant differences. The potential functional organization differences in the CC that may contribute to the disorder of autism will be discussed.

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#### **O. TUCHA, S. KÜBBER, R. LAUFKÖTTER, M. LINDER, L. MECKLINGER, H.E. KLEIN, & K.W. LANGE. Sustained Attention in ADHD.**

It is generally agreed that a sustained attention deficit represents the most prominent disturbance of attention in children and adults with attention deficit hyperactivity disorder (ADHD). This conclusion has been drawn primarily from studies in which only summary scores were considered. However, previous research and theoretical considerations may bring these summary scores into question in regard to the assessment of sustained attention. The present study has examined vigilance and sustained attention in healthy participants and both children and adults with ADHD using a computerized vigilance task. The results show that both children and adults with ADHD performed significantly poorer on the vigilance task than healthy participants (main effect for group) as indicated by an increased number of omission and commission errors. In addition, both children groups and both adult groups showed a significant increase in omission errors over time (time-on-task effects). However, there was no greater decrement of sustained attention with the passage of time in patient groups than in control groups (group by time interaction). Thus, the results do not support the hypothesis of a sustained attention deficit in children and adults with ADHD.

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#### **D. WONG, M. MAYBERY, D. BISHOP, A. MALEY, W. HILL, & J. HALLMAYER. Executive Function and Theory of Mind in Autism: Independent Impairments Underlying Distinct Symptoms?**

Impairments in both executive function (EF) and theory of mind (TOM) have been demonstrated in children with autism spectrum disorders. It has been proposed that TOM tasks rely heavily on executive abilities and that failure on TOM tasks may simply represent executive impairment. However, several recent studies on patients with frontal lobe dysfunction have indicated that while TOM and EF are both subserved by the prefrontal

cortex, they are dissociable functions which can be independently impaired. This study examined 1) whether TOM and EF are independent deficits in autism, and 2) whether or not TOM and EF underlie different aspects of autistic symptomatology—with the focus in this study being on repetitive and stereotyped behaviours. Forty-seven children with autism spectrum disorders and 53 control children were tested on tasks measuring TOM and different components of EF (inhibition, planning, flexibility, and fluency). Repetitive behaviours were measured using a parental interview. It was found that group differences in TOM scores disappeared when measures of fluency and planning, but not inhibition or flexibility, were introduced as covariates. Within the autism group, measures of inhibition, flexibility, and fluency were significantly correlated with the presence and severity of different types of repetitive behaviours, but TOM scores were not. These results suggest that TOM is independent from some components of EF but not others. The finding that EFs correlate with repetitive behaviours but TOM does not further implies that the two cognitive domains underlie different aspects of autistic symptomatology.

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### **MEDICAL NEUROPSYCHOLOGY**

#### **TH. GOEHRINGER, L. SCHAAF, & J. ZIHL. Neuropsychological Profile in Patients With Diabetes Mellitus.**

Patients with diabetes mellitus can develop neuropsychological deficits in addition to secondary physical diseases such as neuropathy or retinopathy. These appear to correlate with the quality of the disease management. Only in the last several years have the neuropsychological aspects of diabetes mellitus gained increased attention. *Aims:* We examined diabetic patients whose blood-glucose level is too high due to a poor disease management and who do not suffer from hypoglycemic episodes or any diabetes-associated secondary physical disease. It is assumed that long-term hyperglycemic states can impair cognitive functions. *Methods:* Type-1 and type-2 diabetics each with a poor disease management (HbA1c > 8.5 percent) were tested with a standardized neuropsychological test battery. The following cognitive functions were of particular interest: attention/concentration, short-term and working memory as well as problem solving. Type-1 and type-2 diabetics each who have a good disease management (HbA1c < 7.5 percent) as well as healthy non-diabetic subjects serve as a control-group. *Preliminary results:* Diabetics process less information in selective-attention tests (d2) (type-1:  $p < .05$ , type-2:  $p < .01$ ) and show more errors (type-1:  $p = .03$ , type-2:  $p = .001$ ) than a healthy control group. In working-memory tests (TAP) patients do not differ in a one-back task, whereas in a two-back task they differ with respect to reaction time (type-1:  $p = .05$ , type-2:  $p = .003$ ) and number of errors (both groups:  $p = .03$ ). *Conclusions:* Type-1 and type-2 diabetics do show specific impairment in tests for selective attention, speed of information-processing as well as working-memory in comparison to a healthy control group.

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#### **T. KUBIAK, N. HERMANN, B. KULZER, & T. HAAK. Effects of Experimentally Induced Mild and Moderate Hypoglycemia on Attentional Functioning in Type 1 Diabetes Patients—Potential Role of Hypoglycemia Unawareness.**

*Aim:* To assess potentially differential effects of hypoglycemia on neuropsychological functioning in type 1 diabetes mellitus (T1DM) patients with or without hypoglycemia unawareness syndrome using experimental induction of hypoglycemia (hyperinsulinemic glucose clamp technique). *Methods:* Independent variables: (1) "hypoglycemia aware" ( $N = 16$ ) versus "unaware" ( $N = 12$ ) T1DM patients; (2) hypoglycemic level: mild (3.4 mmol/L) versus moderate (2.5 mmol/L); (3) within subjects factor: phase 1 (euglycemia, baseline)—phase 2 (hypoglycemia)—phase 3 (euglycemia, recovery). Two computerized neuropsychological tests were

used for assessment in each phase (divided attention task, flexibility; TAP (Psytest, Herzogenrath/Germany). *Results:* Test performance in "unaware" patients was worse in both tests, even at baseline euglycemia ( $p < .01$ ). Both groups responded to moderate hypoglycemia with deterioration in performance (group  $\times$  within: n.s.). Differential effects of mild hypoglycemia were observable with no deterioration in "unaware" patients and decrease in performance in "aware" patients (divided attention, group  $\times$  within:  $p < .05$ ). *Conclusions:* (1) the effect of hypoglycemia on deterioration in the neuropsychological functions studied was demonstrated; (2) results suggest a shift in glycemic thresholds for neuropsychological effects of hypoglycemia in "unaware" T1DM patients (moderate vs. mild hypoglycemia); (3) clinically, differential baseline levels in performance may contribute to difficulties in "unaware" T1DM patients (narrowing of time window for self-treatment).

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#### **P. KULISTAK. Reversibility of Cognitive Functions in Hepatal Encephalopathy (N = 1).**

Encephalopathy is one of the symptoms of hepatic insufficiencies in cirrhosis. In our case study we present the patient JR, who had been examined before transplantation and three years after it (patient was selected out of the sample  $n = 40$ ). A man, 50 years old, having higher education, active sportsman, full rent for disability (hepatic cirrhosis). *Methods:* IQ (WAIS-R); visual-constructive memory (ROCF); memory of symbols; executive functions (Trail Making test: version A and B, Stroop, WCST); reaction time simplex and disjunctive (visual and auditive modality); finger tapping test. *Results:* Statistically significant improvement occurred in the general intellect ( $t = -4.08$ ;  $p < .001$ ; verbal:  $t = -3.08$ ;  $p < .01$ ; performance:  $t = -2.63$ ;  $p < .05$ ); executive function (WCST:  $t = 2.43$ ;  $p < .05$ ; Stroop  $t = 4.42$ ;  $p < .01$ ; Trail-making A: before 10th percentile, after 75th percentile; B: before 25th percentile, after 75th percentile); delayed memory recall (ROCF: 35th percentile before transplantation to 55th percentile after it); reaction time was also improved ( $t = 3.19$ ;  $p < .01$ ) and finger tapping. Also "personal parameters" were changed assessed by the MMPI and the Luescher. *Conclusion:* We have verified an assumption on extensive reversibility of considerably affected brain cognitive functions in encephalopathy, caused by liver disease—cirrhosis, treated by liver transplantation; only partial cognitive insufficiencies persist. *Correspondence:* *Petr Kulistak, Dept. of Neurology, Videnska 800, CZ-140 59 Prague 4, Czech Republic. E-mail: petr.kulistak@volny.cz*

#### **M. SCHMITZ, S. WERY VON LIMONT, C. BARDONG, C.F. RIESS, J. KORMANN, & B. DAHME. Cognitive Effects of Hypothermic Versus Normothermic CPB.**

We investigated whether hypothermia or normothermia is more protective to the brain as indicated by measures of cognitive function or by changes in serum concentrations of S100 B protein, a biochemical marker of cerebral injury. 49 patients undergoing coronary artery bypass grafting were randomized to 1 of 2 groups: (1) hypothermic ( $32^{\circ}\text{C}$ ,  $n = 24$ ) or normothermic ( $37^{\circ}\text{C}$ ,  $n = 25$ ) CPB. Neuropsychologic performance was assessed before, 1 day after and 5 days after the operation. Serum S100 B protein levels were measured at 5 intervals up to 48 hours after surgery. While neuropsychologic assessment failed to identify clear benefits for one of the operation techniques, serum S100 B protein concentrations were higher at the end of ECC in the hypothermic group, but significant differences between both groups had disappeared 24 hours later. The significant different levels in S100 B serum protein concentration point out that the blood-brain barrier may be more negatively influenced during hypothermia, but this may not be reflected in detectable neuropsychologic deterioration.

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#### **A. JAVURKOVA. Pre-/Postsurgical Neuropsychology Assessment in Temporal Lobe Epilepsy.**

A group of patients with temporal lobe epilepsy (TLE) was studied using lateralizing value of presurgical neuropsychological assessment and predicting value of postsurgery neuropsychological alteration. We present original data of patients with TLE, who underwent surgery for intractable epilepsy and had neuropsychological assessments one and two years following surgery. The following neuropsychological tests (WAIS-III, RAVLT, ROFT, RMT, FAS, DF, BDI, EPQ/R, WADA test) were performed for lateralization of verbal/nonverbal memory deficits in the presurgical period and compared with postsurgical assessment. For prediction of post-operation level of memory, we studied these factors: duration of epilepsy, age at time of operation, frequency of seizures before/after operation, level of intelligence and kind of memory before operation, psychosocial problems and quality of life. There were three groups of patients: first, patients with improvement of memory on the contralateral/ipsilateral side of surgery; second, patients with decline of memory on the contralateral/ipsilateral side; and finally patients with the same level of memory. We found our neuropsychological assessment useful for lateralising value in presurgical assessment. Predicting value of neuropsychological assessment for postsurgery alteration of memory will be discussed. There is clear evidence of many factors which influence memory in TLE patients following surgery. Improvement and decline depend namely on interictal epileptiform discharges, duration of epilepsy, age of patients and on pre-operation level of intellectual and memory functioning.

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#### **J. MAIR, M. BOHRER, S. OERTEL, W. HACKE, & F. WENZ. Prospective Assessment of Change in Cognitive Functions Following Whole Brain Irradiation.**

*Purpose:* Neuropsychological changes at distinct points of time during and after whole brain irradiation were assessed. *Method:* 37 patients participated in this study receiving whole brain irradiation for two different reasons: 10 patients (n1) received prophylactic cranial irradiation, 27 patients (n2) received therapeutic cranial irradiation due to brain metastases. A battery of standardized neuropsychological tests was applied assessing intelligence, verbal and non-verbal memory, attention, emotional condition and quality of life at several points of time in the course of and after therapy. *Results:* Before therapy, none of our patients showed cognitive impairment (IQ  $104.05 \pm 15.09$ ). As the follow-up examinations are not yet concluded not all data have been gathered yet. So far no impairment of cognitive functions can be observed comparing neuropsychologic capability before and after four months of therapy. *Conclusion:* Four months after termination of whole brain irradiation no decline of cognitive functions was observed. However impairment of cognitive functions in a longer follow-up can not yet be excluded.

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### **NEUROPSYCHIATRY**

#### **T. BEBLO, A. SILVA SAAVEDRA, C. MENSEBACH, & M. DRIESSEN. Neuropsychological Correlates of Traumatization in Borderline Personality Disorder.**

The majority of patients with Borderline Personality Disorder (BPD) show a history of severe traumatization and patients seem to exhibit subtle neuropsychological deficits. Since neuropsychological deficits are also known in trauma-related disorders like PTSD this study mainly aimed at the investigation of relations between type, severity and age of traumatization and neuropsychological performance. Twelve BPD-Patients and 12 healthy controls were included into the ongoing study. For the clinical diagnosis SKID I and SKID II were applied. Additionally, self and ob-



server rating scales and a comprehensive neuropsychological examination were conducted in all subjects. All BPD-Patients reported traumatic events and 50% suffered from a comorbid PTSD. With regard to neuropsychological performance, most patients were unimpaired, but some showed extremely heterogeneous neuropsychological profiles. Severity and age of traumatization were correlated with neuropsychological impairment, primarily memory dysfunction. These findings support the notion of an association between traumatic stress and functional and/or structural brain dysfunction. This association might be explained by neurotoxic effects of stress hormones of the HPA-axis or, alternatively, by the fact that people with subtle brain dysfunction are more likely to develop a trauma related disorder.

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#### **R. CHAN & E. CHEN. Psychological Distance of Semantic Categorization in Schizophrenia.**

This study aimed to examine the psychological distance of categorization in schizophrenia. A cross-sectional design was adopted with a total of 187 patients with schizophrenia and 98 normal controls. Participants were asked to generate as many exemplars from within a semantic category as they could in 3 minutes. The categories selected for this study were "Animal", "Means of Transport", "Food" and "Furniture". Analysis using the Rasch Model was undertaken. The findings indicated that the psychological distance, in terms of logits unit, was not at an equal interval within each category across the 3-min interval in both patients and healthy controls. The psychological distances between different categories were also found to be inconsistent in both groups. These preliminary findings suggest that we should not simply equate different category scores when we study semantic categorization. Such a simple "count" of categories may not sufficiently reflect the actual psychological distance perceived by patients and healthy controls. Future study should further examine a more representative and accurate measurement of semantic categorization.

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#### **T. CHERNIGOVSKAYA, S. DAVTYAN, & K. STRELNIKOV. Prosody Perception in Schizophrenic Patients: Hemispheric Involvement.**

Schizophrenic patients were recently shown to differ from healthy subjects in brain functional asymmetry in both automatic and controlled processing. Among other findings left hemisphere abnormalities revealed in dichotic testing were associated with auditory hallucinations. However, brain mapping studies of language perception in schizophrenia gave no evidence of reduced activity in the left hemisphere, with decreased level of cerebral asymmetry possibly resulting from failure to inhibit the right hemisphere. We administered a dichotic listening procedure to 50 patients with 50 healthy controls. Stimuli were phrases with different types of linguistic and emotional prosody. Percentage of mistakes and reaction time were analysed for each ear. No evidence of ear advantage in number of correct reactions in both groups was found. In contrast, right ear advantage (REA) in latency was shown for healthy subjects processing utterances with logical stress *versus* left ear advantage (LEA) in processing emotional and unfinished utterances. In patients with schizophrenia REA for utterances with different logical stress was revealed with no asymmetry for the other types of prosody. Negative correlation between relevant responses and duration of illness, age, early onset, and ratings of negative symptoms were shown. There was no significant correlation with illness course type, rating of positive symptoms, level of education, or gender. We argue that the level of hemispheric activation in schizophrenia may differ depending both on the actual status of a patient (e.g., contribution of the negative and positive symptoms) and specificity of linguistic procedures. Correspondence: *Tatiana Chernigovskaya, Saint-Petersburg State University, Universitetskaya Nab. 7-9, 199034 Saint-Petersburg, Russia. E-mail: tatiana@tc3839.spb.edu*

#### **R. DRECHSLER, A.C. LANG-DULLENKOPF, H.-C. STEINHAUSEN, & D. BRANDEIS. Processing of Facial Affect in Early-Onset Schizophrenia: An ERP Study.**

**Objective:** Characteristic patterns in the processing of facial affect have been reported in adult schizophrenic patients. Neuropsychological studies indicate that they have difficulties in correctly labeling facial expression, and that their brain electric activity following the face-specific N170 component is reduced. The aim of our study was to examine whether these characteristics can also be found in adolescents with schizophrenia, which to our knowledge has not been studied before. **Method:** A group of patients with early-onset schizophrenia, a group of clinical controls, and a group of healthy adolescents, ages 13 to 17, participated in the study. Neuropsychological and electrophysiological measures were combined: A task of labeling facial expressions was performed during a 47 channel ERP recording. A series of faces of adolescents and young adults with emotional or neutral expressions was presented on a PC screen. Each face was followed by a word representing an emotional category which could be accepted or rejected. **Results:** Preliminary results indicate that adolescents with schizophrenia ( $N = 4$ ) seem to present reduced amplitudes compared to adolescent healthy controls during the P100 and N170 components, which recent work implicates in affective face processing. In the categorization task of facial affect, however, schizophrenic adolescents followed a similar pattern as seen in controls, although they made more errors over all emotional categories. **Conclusion:** Further research will show whether these results can be replicated and whether the observed effects are due to a deficiency in the processing of facial affect or to more basic problems in information processing.

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#### **K. FAST, S. HERPERTZ, & K. SCHNELL. Controlling Emotional Arousal in Patients With Borderline Personality Disorder (BPD).**

Biological and behavioral data suggest that emotions are control signals that regulate responses to changing circumstances. BPD is hallmarked by a dysregulation of emotional arousal. It is suggested that a decreased tolerance towards high arousing fear stimuli is related with trait anxiety in general. We used multiple measures to compare attention during self-controllable exposure to emotional arousing stimuli. 12 BPD patients and 12 healthy controls were examined with a paradigm of stochastic variations of emotional arousing visual stimuli. All participants are instructed to control the length of presentation of negative high arousing, negative low arousing, and neutral pictures by pressing a button. Compared with controls, BPD patients were characterized by a delayed reaction time, hyperactivity of amygdala, and hypoactivity of prefrontal regions for negatively arousing pictures. The results support that strong negative pictures capture attention more than weak negative pictures as well as provoke a higher subjective arousal and a slower habituation time-line. Studies have shown in healthy people stimuli that pose an immediate threat to survival automatically attract attention. The influence of threatening stimuli on attention is moderated by trait anxiety. Dysregulation in BPD might be explained by an increased signal function of high arousing negative stimuli but a reduced behavioral profit (fight/flight response) as a consequence of trait anxiety. Future research should explore the role of emotions as control signals in self-regulating and intentional behavior in BPD patients.

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#### **T. HEINKS, M. GRAY, & J. FORD. Impairment of Working Memory and Mismatch Negativity Generation in Schizophrenia.**

Schizophrenia is a severe mental disorder associated with a very heterogeneous pattern of cognitive and neuropsychological performance. However, short-term-memory dysfunction represent a fairly consistent finding in this disorder. Event-related potentials (ERP) provide a reliable tool to investigate potential mechanisms underlying some of the perceptual and cognitive dysfunctions in schizophrenia. Mismatch-negativity (MMN) is

an auditory cognitive ERP component that indexes operation of auditory sensory memory and has often been found to be abnormal in schizophrenia. Studies have linked this deficit to the widespread working memory impairment associated with this disorder. In our study, we recognize the wide scope of impairment by investigating the difference in MMN to new and conventional types of stimuli: (1) the subject's own pitch-shifted speech sounds while they were being produced, (2) played-back prerecorded speech sounds consisting of the subject's own pitch-shifted and someone else's voice, and (3) tones different in pitch. In addition, the subjects underwent a thorough neuropsychological assessment. Preliminary results show an impaired MMN generation in schizophrenia to all stimulus conditions applied in this study. Neuropsychological data indicate no overall cognitive impairment in the patients; contrarily—intellectual performance measured by the WAIS-III was average to above average in most patients. However, in tests related to working memory, we found a distinctive pattern of lower performance as compared to other areas of cognitive functioning. These findings seem to strengthen the proclaimed connection between impaired MMN generation and working memory dysfunction in schizophrenia.

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**R. LOOSE, M. JOHANN, G. BOBBE, G.L. ALDERS, N. WODARZ, & K.W. LANGE. Attentional Disorders in Alcoholic Patients.**

Chronic alcohol abuse is associated with cognitive deficits in a variety of neuropsychological functions including memory performance. Much less is known about attention deficits in alcoholic patients. Neuropsychological examination was performed in 80 alcohol-dependent patients after an abstinence period of four weeks. Subjects with liver cirrhosis, head trauma, dependence on substances other than alcohol, a history of or signs of Korsakoff's syndrome, a history of or signs of other psychiatric or neurological symptoms and patients on medication were excluded from the study. Sixty-one healthy volunteers served as control subjects. Patients and healthy controls did not differ significantly in age or years of education. Performance in most attention tasks (reaction times) was similar in both patient and control groups. There were no statistically significant differences in tonic alertness, phasic alertness, selective attention, or divided attention. In the divided attention task, alcoholic patients showed an increased number of omission mistakes. An increased number of false alarms was calculated for the alcoholic patients in the selective attention task. Alcoholic patients, however, showed markedly impaired cognitive flexibility (shift of attention), as indicated by increased reaction times and wrong reactions. Basic attentional mechanisms such as alertness were unimpaired in alcoholic patients. Impairments increased, however, when executive processing was involved in the attentional tasks. As a result, minor deficits in selective and divided attention and marked impairments in cognitive flexibility were observed. Attentional disorders in alcoholic patients may therefore be attributed to executive impairments.

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**M. MATSUI, K. KATO, H. YUUKI, A. TAKEUCHI, & M. KURACHI. Response Characteristics on a Guessing Task in Schizophrenic Patients.**

Schizophrenic patients generally perform poorly on tasks that address executive functions. Particularly, patients have difficulty solving problems when solutions are not apparent, or when they must rely upon novel recombination of existing knowledge. Guessing is an important component of everyday cognition. The purpose of this study was to examine their thinking processes using a guessing task in patients with schizophrenia spectrum disorders. Participants were 17 patients (9 men and 8 women) who fulfilled the ICD-10 diagnostic criteria for research on schizophrenia or schizotypal disorder and 33 healthy comparison subjects (13 men and 20 women). We developed a guessing task for the study of thinking processes and administered this to patients with schizophrenia spectrum dis-

order and normal controls. The task required the participant to ask the fewest number of yes/no questions possible in order to identify the unknown target object. We classified every response of the participants with seven categories: categorical, functional, relational, physical, personal, random or inefficient questions. We compared the frequency of questions in each category between patients and normal controls. The results showed these patients with schizophrenia spectrum disorder asked fewer functional questions and more random or inefficient questions than normal controls. These data suggest that ability of dealing with uncertainty in patients with schizophrenia spectrum disorder is different from that in normal controls. Decreased functional questions and/or increased inefficient questions in patients with schizophrenia spectrum disorder may be crucial factors in coping with daily situations including novel information. Correspondence: Mié Matsui, Ph.D., Department of Psychology, School of Medicine, Toyama Medical and Pharmaceutical University, 2630 Sugitani, Toyama 930-0194, Japan. E-mail: mmatsui@ms.toyama-mpu.ac.jp

**K.A. NOLAN, J. VOLAVKA, J.L. KENNEDY, P. CZOBOR, J.-P. LINDENMAYER, L. CITROME, J. McEVOY, M. CHAKOS, & J.A. LIEBERMAN. COMT Genotype and Hostility in Schizophrenia.**

A common functional polymorphism in the gene controlling one of the main enzymes in catecholamine metabolism, catechol O-methyltransferase (COMT), has previously been associated with a history of overt violence in patients with schizophrenia or schizoaffective disorder (SC). Violent patients are more frequently homozygous for the low activity (Met) allele than non-violent patients (Strous et al., 1998; Lachman et al., 1998). These results have been replicated in other studies that also specifically selected subjects with a history of overt violence. This study examined the association between COMT genotype and hostility in patients with schizophrenia or schizoaffective disorder. The 60 subjects in this study were participating in a comparative study of the clinical effects of clozapine, olanzapine, risperidone, and haloperidol. The subjects were not selected for violence. Subjects who were homozygous for the Met allele scored significantly higher on the Hostility item of the Positive and Negative Symptom Scale (PANSS) (mean 3.5 [sd 1.8]) vs. the other subjects (2.24 [1.3],  $F = 5.22$ ,  $df 1,58$ ,  $p < .026$ ). These data indicate that the COMT Met allele is associated not only with overt violence but also with a lower level of aggressive feelings and behaviors (i.e., hostility). These findings will be discussed in the context of recent reports that the COMT Met allele is also associated with better performance on cognitive measures of prefrontal function.

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**K.A. NOLAN, R.M. BILDER, H.M. LACHMAN, & J. VOLAVKA. Competing Programs Performance Related to COMT Genotype in Schizophrenia.**

The activity of a primary enzyme in catecholamine metabolism, catechol O-methyltransferase (COMT), is governed by a common functional polymorphism. Several recent studies demonstrate that the COMT 158 polymorphism is associated with cognitive and behavioral phenotypes in patients with schizophrenia (SC). The met (low enzyme activity) allele has been associated with history of aggression and reduced perseverative errors on the Wisconsin Card Sorting Test (WCST). The val (high-activity) allele has been associated with decreased efficiency in the dorsolateral prefrontal cortex (DLPFC) and anterior cingulate (ACC) and with worse (slower) performance on tasks measuring processing speed and attention. We have examined the COMT 158 polymorphism and performance on a computerized competing programs task in 26 patients with schizophrenia and schizoaffective disorder. This task requires uncued alternation between two rules of responding—imitation and reversal. The subject first learns to respond by imitating each of two stimuli (e.g., one bar press for a single stimulus, two bar presses for a double stimulus), then to respond in the opposite fashion (two bar presses for a single stimulus, one bar press for a double stimulus). The subject must deduce response rules and shifts from

one rule to another from accuracy feedback. Val homozygotes had the slowest reaction times ( $F = 4.755$ ,  $df = 2,23$ ,  $p = .019$ ). Patients with Met homozygotes showed better acquisition of the imitation response set in terms of trials to criterion ( $F = 4.375$ ,  $df = 2,23$ ,  $p = .025$ ) and showed the greatest processing "cost" when shifting from imitation to reversal ( $F = 7.226$ ,  $df = 2,23$ ,  $p = .004$ ). These findings are consistent with the hypothesis that the Met allele leads to increased availability of tonic dopamine, with general benefits for cognitive stability, but costs specifically in the capacity to flexibly alter behavioral programs. This hypothesis may help explain how the Met allele can be associated with both better cognitive performance on some tasks and increased aggressive behavior.

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**R.W. PARKS, K. LEE, R. GREEN, M. HUNTER, T. FARROW, S. SPENCE, & P. WOODRUFF. Insight and Attention in Behavioral Assessments of Chronic Schizophrenia.**

Compromised insight is a cardinal feature of psychosis and is a major predictor of non-compliance in schizophrenia. In the current study, our aim was to investigate the relationship between insight and neuropsychological attention test performance in patients with schizophrenia. Insight in psychosis, as assessed by David's (1990) Insight Assessment Scale (IAS), is composed of three dimensions—the patient's awareness of illness, capacity to re-label psychotic experiences as abnormal, and treatment compliance. Prior neuropsychological research supports the idea that sustained attention and concentration are related to insight. We hypothesized that individuals' (males with schizophrenia:  $n = 8$ , mean age = 29 years) rating scores on the IAS would be correlated with a standardized neuropsychological test of attention, the Auditory Attention Test (AAT). Results showed a positive correlation between the IAS and AAT. Improved insight was associated with better auditory attention. The number of false positives on the AAT was negatively correlated with IAS score. These findings suggest that degree of insight is related to the patient's level of attention and ability to inhibit irrelevant responses. The question arises as to whether these behavioral and neuropsychological measures could have a neural correlate in the fronto-subcortical system.

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**T.T. PHAM, S. REMY, & A.M. BERARDI. Personality Traits in Suicide Attempters and Controls.**

The aim of this study was to determine whether suicide attempters and controls differ on personality traits, namely self-esteem, neuroticism, extraversion, depression, trait and state anxiety. Twenty patients hospitalized for recent suicide attempts and twenty controls matched for age ( $24.20 \pm 6.59$  and  $22.40 \pm 4.15$  years for suicide attempters and controls, respectively; range: 15–35), sex (5 Males/15 Females) and education (coded level:  $4.95 \pm 1.10$  and  $5.60 \pm 1.57$  for suicide attempters and controls, respectively) were studied. All subjects were screened for major psychiatric disorders. Subjects were administered the Coopersmith Self Esteem Inventory, the Eysenck Personality Questionnaire, the Beck Depression Inventory and the Spielberger State-Trait Anxiety Inventory. Results were analyzed with one-way analyses of variance with one between group factor (suicide attempters vs. controls) and one within group factor (the score on each test). Suicide attempters had higher scores than controls on depression ( $p = .0001$ ), state and trait anxiety (both  $p = .0001$ ), and neuroticism ( $p = .07$ ) measures. Suicide attempters also had lower scores than controls on extraversion ( $p = .04$ ) and on all self-esteem measures (general:  $p = .005$ ; total:  $p = .002$ ; social:  $p = .006$ ; familial:  $p = .003$ ; professional:  $p = .06$ ). Results suggest that young adults who are anxious and introverted, have lower self esteem and elevated symptoms of depression, may be at increased risk for suicide attempts. Personality traits should be considered for the prevention of suicide attempts in young adults.

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**M. PIECHATZEK, F. INDLEKOFER, C. VAN NIEKERK, H.-U. WITTCHEN, & C. SCHÜTZ. Neuropsychological Deficits and Related Psychiatric Disorders in Club Drug, Regular Cannabis, and Harmful Alcohol Users.**

Unspecific neurocognitive deficits such as inability to learn from experience, failure to inhibit errors in learning and remembering, difficulties in allocating cognitive resources in a strategic fashion, difficulties in ignoring irrelevant information are reported in club drug, cannabis and alcohol users. We developed a neuropsychological test battery to explore the specific functions which we suggested to be impaired. We focused on memory, attention and executive functions. Moreover, longitudinal data about psychiatric diseases are available which allowed us to analyse correlations between neuropsychological and psychiatric disorders. The sample is based on the early developmental stages of psychopathology study (EDSP) with  $N = 3021$ —a longitudinal study including more than 1000 drug and harmful alcohol users 14 to 24 years of age at baseline in 1995. The sample has been followed over 5 years with the Munich-Composite International Diagnostic Interview (CIDI). It offers the unique opportunity to provide a cross-sectional and longitudinal characterization of neurocognitive and psychopathological problem profiles and their relationship to substance use. A nested case-control study with one experimental assessment to evaluate attention, particularly selective, sustained and divided attention, memory and executive processes was completed. Four experimental groups consisted of subjects with harmful alcohol, regular cannabis use, club drug use and a 'non-using' control group ( $N = 80$  each). Results will be presented based on the current sample, probably 20 subjects per group. Neurocognitive deficits are both an important consequence and risk factor, which we are only beginning to understand.

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**M. REGARD, D. KNOCH, & T. LANDIS. Brain Damage and Addictive Behavior: A Neuropsychological and EEG Investigation With Pathological Gamblers.**

Gambling is a form of non-substance addiction classified as an impulse control disorder. Pathological gamblers are considered healthy with respect to their cognitive status. Lesions of the fronto-limbic systems, mostly of the right hemisphere are associated with addictive behavior. Since gamblers are not regarded as "brain-lesioned" and gambling is not toxic, gambling is a model to test whether addicted "healthy" people are relatively impaired in fronto-limbic neuropsychological functions. 21 non-substance dependent gamblers and 19 healthy subjects underwent a behavioral neurological interview centered on incidence, origin, and symptomatology of possible brain damage; a neuropsychological examination, and an electroencephalogram. 17 gamblers (81%) had a positive medical history for brain damage (mainly traumatic head injury, pre- or perinatal complications). The gamblers compared to the controls were significantly more impaired in concentration, memory, and executive functions and, evidenced a higher prevalence of non-right-handedness (43%) and, non-left-hemisphere language dominance (52%). EEG revealed dysfunctional activity in 65% of the gamblers compared to 26% in the controls. This study shows that the so-called "healthy" gamblers are indeed brain-damaged. Compared to a matched control population, pathological gamblers evidenced more brain injuries, more fronto-temporo-limbic neuropsychological dysfunctions, and more EEG abnormalities. We thus conjecture that addictive gambling may be a consequence of brain damage, especially of the fronto-limbic systems, a finding that may well have medico-legal consequences.

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**S. REMY & A.M. BERARDI. Relations Between Sensation Seeking and Suicide Attempts in Young Adults.**

To test the hypothesis that suicide attempters may be high sensation seekers, 3 groups of women were studied: 12 suicide attempters, 25 high and 19 low sensation seekers. High and low sensation seekers never made a



suicide attempt. All groups were matched on age and education (all  $F < 1$ ). High and low sensation seekers were determined on the basis of their total score on the Sensation Seeking Scale-Form V (SSS). Mean total score on the SSS for subjects who never made a suicide attempt was 21.98. Subjects with scores above the mean were considered high sensation seekers and subjects with scores below the mean were considered low sensation seekers. Results were analyzed using one-way ANOVAs with one between-group factor (suicide attempters vs. high sensation seekers, suicide attempters vs. low sensation seekers, high vs. low sensation seekers). No significant differences were found on the SSS total score and its subscales between suicide attempters and high sensation seekers (all  $p > .21$ ). Suicide attempters had higher scores than low sensation seekers on the SSS Total score ( $p = .001$ ), on the Thrill and Adventure Seeking ( $p = .007$ ), Experience Seeking ( $p = .003$ ) and Boredom Susceptibility subscales ( $p = .03$ ). Suicide attempters did not differ from low sensation seekers on the SSS Disinhibition subscale ( $p = .24$ ). High and low sensation seekers differed on all SSS subscales (all  $p < .005$ ). These results show that SSS patterns in suicide attempters are similar to those of high sensation seekers without evidence of suicide attempts, and suggest that suicide attempters are high sensation seekers.

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**M.M. SITSKOORN, A. ALEMAN, S.J.H. EBISCH, M.C.M. APPELS, & R.S. KAHN. Meta-Analysis of Neurocognitive Deficits in Relatives of Patients With Schizophrenia.**

Cognitive deficits in schizophrenic patients are especially prone in the domains of verbal memory, executive functioning and attention. The deficits are already present early in the course of the illness and thus may be independent to factors such as medication or chronicity. Family studies indicate that there is an important genetic contribution to the etiology of schizophrenia. Therefore, one might hypothesize that non-schizophrenic relatives exhibit similar cognitive deficits as schizophrenic patients. If deficits in relatives indeed parallel the deficits found in patients, they might be suitable endophenotypic markers for schizophrenia. We conducted a meta-analytic review of the published literature on neurocognitive performance of relatives of patients with schizophrenia. We report 9 weighted effect sizes from 37 studies comprising 1639 relatives of schizophrenic patients and 1380 healthy control subjects to index relatives *versus* control differences. Some studies contained results of multiple relevant tests and were included in more than one analysis. The largest difference was found on the variable delayed verbal memory recall,  $d = .54$ , followed by tests measuring executive functioning and attention with effect sizes in the small to moderate range ( $d = .28$ – $d = .51$ ). The results of our meta-analysis show that cognitive deficits in relatives of schizophrenic patients parallel the deficits found in patients themselves. The data suggest cognitive variables that might be valuable endophenotypic markers in schizophrenia. By using these endophenotypic markers, genetic heterogeneity might be reduced and the power of linkage studies improved. In this way, our findings can facilitate the search for susceptibility genes for schizophrenia.

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**B. WENNING, K. LAMPE, A. ANSMANN, K. SCHNELL, & S. HERPERTZ. The Influence of Emotions on Inhibition in Borderline Personality Disorder.**

Maladaptive personality functioning in Borderline Personality Disorder (BPD) is closely related to an impulsive cognitive and behavioral style which predominates in states of emotional arousal. BPD patients may fail to inhibit the processing of task-irrelevant negative stimuli, so that they have difficulties in maintaining goal-directed behavior. The aim of our study is to show 1) that these patients have inhibitory deficiencies in the presence of emotional stimuli only, and 2) that these deficiencies can be reduced by a cognitive-behavioral psychotherapy. In our study 25 patients with BPD and 25 healthy controls are given four neuropsychological tasks

for assessing interference control, automatic and intentional cognitive inhibition as well as behavioral inhibition at the beginning and ending of their treatment. Interactions between the quality of performance and both, state (actual mood) and trait conditions (emotional hyperreagibility) were taken into consideration. Preliminary data proposed deficient automatic and intentional cognitive inhibition capacities in the context of negative emotional, but not neutral stimulus material. Data on therapy outcome are currently being assessed. BPD patients have difficulties in the cognitive regulation of negative emotions. The motivational system (mediated by subcortical limbic areas) and the attentional system (mediated by cortical prefrontal areas) do not effectively interact for the benefit of self-regulation and goal-directed behavior. This could refer to an exceeded bottom-up control of the amygdala and a reduced top-down control of the medial prefrontal cortex.

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**S. LAUTENBACHER, A. ALBERT, T. BEBLO, A. BRUNNAUER, R. BROCKHAUS, B. BROKATE, E. GEIGER, B. KUNDERMANN, L. MEIER, A. SCHEURICH, K. STÖHR, & B. WEBER. The Situation of Neuropsychology in Psychiatry: A Questionnaire Survey in German-Speaking Countries.**

Neuropsychology has traditionally focused on neurological disorders. Available education and positions have mirrored this bias towards neurology. However, mental disorders have meanwhile repeatedly proven to be brain disorders which can be managed successfully in a neuropsychological paradigm. Nevertheless, the situation of neuropsychology in psychiatry is far from clear in German-speaking countries. Consequently, a special interest group in the GNP developed a short questionnaire (11 items) for that purpose. The addresses of 936 hospitals or departments of hospitals for psychiatry and psychotherapy (for children, adolescents and adults) were selected from the German hospital guide for Austria, German and Switzerland. According to a preliminary evaluation of 273 returned questionnaires a representative sample of hospitals with mainly adult patients (77%) and varying sizes from below 50 (25%) to above 200 patients (12%) could be engaged. In most of the cases (81%) the psychologists do not spend more than 25% of their total working hours on neuropsychological questions. The number of psychologists with a preponderance of neuropsychological everyday jobs (in 95% of the hospitals not more than 2 psychologists) and with a training in Neuropsychology (in 90% of the hospitals not more than 2 psychologists) is small. However, if working hours were summed up, the amount of positions devoted to Neuropsychology appears to be substantial (more than 1 full position in 42% of the hospitals). In summary, a high portion of the working hours of psychologists in psychiatry in German-speaking countries is spent on neuropsychological questions without allowing yet for a suitable expertise.

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**R. MURPHY, D.O. NUTZINGER, T. PAUL, & B. LEPLow. Neuropsychological Deficits in Obsessive-Compulsive Spectrum Disorders.**

During the last decade, there has been a controversial discussion in psychiatry about disorders which share common phenomenological and neurobiological similarities. Regarding anorexia nervosa (AN), this psychiatric disorder tends to be related to obsessive-compulsive disorder (OCD) and should therefore be part of the obsessive-compulsive spectrum disorders. Based on recent neuroscientific findings, studies assessing frontal lobe functioning in OCD and AN have to be carried out in order to detect a deficit reflecting a basic neurophysiological dysfunction in obsessive-compulsive spectrum disorders. We used the conditional-associative learning paradigm (CAL), in which the participant has to learn associations between a set of six words and six meaningless shapes. Lesions to the human prefrontal cortex produce reliable deficits on CAL-performance. The acquisition of conditional associations using neutral and individually threatening verbal stimuli was assessed in 16 females with anorexia ner-

vosa, obsessive-compulsive disorder, bulimia nervosa and normal controls, respectively. Groups did not differ in terms of age, sex, intelligence, depression, verbal memory or verbal fluency measures. Patients and controls were widely comparable on tests assessing neuropsychological functioning. In the CAL-task only anorectic and OCD-patients displayed an impaired performance with neutral material but not with individually threatening material. Such a deficit was not evident in bulimics or in normal controls. These findings support the assumptions from functional neuroimaging investigations in AN and OCD and provide evidence that obsessive and compulsive behavior could have its origin within common neurobiological dysfunctions. The CAL possibly serves as a functional correlate of neurophysiological dysfunction in obsessive-compulsive spectrum disorders.

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#### **M. WOODMAN & M.T. MARTIN-IVERSON. Stress Hormone Effects on an Animal Model of Attentional Gating in Schizophrenia.**

Stress has been associated with a range of psychiatric and neurological disorders, including Alzheimer's Disease, depression and schizophrenia. However, the exact nature of the role of stress in the aetiology and/or maintenance of the latter remains poorly understood. The current study investigated the effects of two stress-related hormones, corticotrophin-releasing factor (CRF) and corticosterone, on an animal model of attentional gating deficits in schizophrenia; prepulse inhibition of the acoustic startle response (PPI). PPI is the normal attenuation in the magnitude of the startle reflex that occurs when the startle-eliciting stimulus is preceded by a sub-threshold prepulse. Patients with schizophrenia robustly exhibit reduced levels of PPI compared to controls. In the current study 96 male Wistar rats were given injections of either metyrapone (MET: 100 mg/kg, s.c.), a corticosterone synthesis inhibitor, or dexamethasone (DEX: 1.5 mg/kg, i.p.), a synthetic corticosterone selective for the glucocorticoid (GR) corticosterone receptor subtype, CP-154, 526 (CP: 10 mg/kg, i.p.), a CRF antagonist, MET + DEX, CP + MET, CP + DEX, or CP + MET + DEX (all  $n = 12$ ). Metyrapone led to a reduction in PPI and this was reversed by concomitant administration of dexamethasone, suggesting that this effect is due to corticosterone actions on glucocorticoid receptors. CP-154,526 also partially reversed the metyrapone-induced reduction in PPI. Investigations into the effects of stress hormones on animal models of schizophrenia will help to expand our understanding of the complex pharmacology of this illness and have implications for neurodevelopmental theories of the disorder.

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### **Symposium 9/1:00–2:30 p.m.**

#### **THE TIME COURSE OF WORD RECOGNITION: NEW ELECTROPHYSIOLOGICAL EVIDENCE**

**Chair: Arthur M. Jacobs**

**Organizers: Arthur M. Jacobs and Christian J. Fiebach**

#### **A.M. JACOBS. The Time Course of Word Recognition: New Electrophysiological Evidence.**

In recent years fundamental research on word recognition and lexical access has provided results that have a high potential for applications in neuropsychological/clinical contexts involving a broad variety of impairments (dyslexia with or without ADHD, Alzheimer or Parkinson disease, depression). The vast majority of these studies, however, neglect the important issue of the precise time course of word recognition. In the present symposium, researchers interested in neurocognitive investigations of word

recognition will present new electrophysiological data on normal and impaired lexical access with a special emphasis on the time course of word recognition.

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#### **P. KHADER, A. SCHERAG, J. STREB, & F. RÖSLER. Nouns and Verbs Evoke Different Event-Related Brain Potentials, but Topographically Identical N400 Effects.**

The aim of the present study was to enforce the priming of semantic representations of either nouns or verbs in order to evoke word category specific N400 effects. In two experiments two primes which were either a verb-noun or a noun-noun pair were followed by a semantically related or unrelated target which was a noun or verb, respectively. This target always completed the word sequence to a minimal phrase comprising verb, subject, and object (VNN or NNV triplets). In experiment I subjects judged the semantic relatedness of the target to the two primes, in experiment II subjects first generated an appropriate target of the required word category and then judged the semantic relatedness between self-generated word and targets. ERPs were recorded from 124 scalp electrodes. In both experiments verbs and nouns evoked reliably distinct ERP topographies between 300 and 800 ms. With verbs in relation to nouns the amplitudes were more positive over central to frontal and more negative over occipital and temporo-parietal areas. In contrast, N400 effects proved as topographically invariant for noun and verb targets in both experiments. The results suggest that access to noun and verb representations involves topographically distinct cell assemblies while the N400 effect seems to reflect semantic evaluation and integration processes which are more abstract and independent from a particular word category.

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#### **T.F. MÜNTE. Blocking of Lexical Access in the Non-Target Language in Bilinguals.**

In a series of combined event-related brain potential (ERP) and functional magnetic resonance imaging (fMRI) studies, we investigated lexical access in fluent bilingual individuals. In the first study, Catalan/Spanish bilinguals and Spanish monolinguals were shown word-lists that comprised Catalan words (high and low frequency), Spanish words (high and low frequency words) and legal non-words. The task was to press a button for Spanish words and to not press for any other stimulus. While the Spanish words showed a frequency-modulation of the N400 in both groups, no such modulation was found for Catalan words. This suggested that the meaning of Catalan words was not accessed even by fluent Catalan-speakers. When Catalan words were made the target words, the frequency effect was observed but disappeared for Spanish words. The parallel fMRI experiment showed that bilingual speakers enlisted anatomical regions previously shown to be involved in pseudo-word reading which by necessity requires the phonological (alternative) reading route. Thus, bilinguals might rely on the use of this alternative route to suppress interference from the non-target language. We will present additional studies, addressing word production, which show that interference effects are much more prominent in word production.

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#### **A.M. JACOBS, B. RICKER, & A. HAHNE. The Time Course of Successful and Unsuccessful Lexical Access.**

Variations in online processing of letter strings with varying degrees of orthographic-phonological structure (OPS) were investigated using the

event-related potential (ERP) technique in two lexical decision experiments. The ERP record revealed an early categorical lexicality effect (300–400 ms post-stimulus) with nonwords eliciting a larger negativity than words, and a later, parametric effect of OPS for nonwords (400–550 ms): the higher their OPS, the higher were N400 peak amplitudes. We suggest that the lexicality effect represents the electrophysiological marker of a fast word recognition process generating correct 'Yes' responses (i.e., successful lexical access), while the OPS effect represents the operation of a slow process computing 'No' responses for unknown letter strings (i.e., unsuccessful lexical access, as assumed by current computational models of lexical access).

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**S.A. KOTZ, J. HOFMANN, D.Y. von CRAMON, & A.D. FRIEDERICI. Language Related Brain Potentials Comparing Left and Right Anterior Temporal Lobe Lesion Patients: Lexical and Semantic Processes.**

Currently there has been a renewed debate on the role of the left anterior temporal lobe in speech perception. While some recent PET evidence (Scott et al., 2000) indicates that this brain region is involved in speech intelligibility, others have claimed that the anterior temporal lobe is engaged in syntactic processing (Donkers et al., 1994; Friederici et al., in press; Meyer et al., 2000). One question that remains is whether speech intelligibility implies the recognition of lexical-semantic and syntactic information at the sentence level or even at the word level, as we were able to show activation of the anterior temporal lobe during word and pseudo-word processing in an fMRI experiment (Kotz et al., in press). To further investigate this matter we tested a group of patients with left anterior temporal lesions ( $N = 11$ ) and as a control group patients with extended right anterior temporal lesions ( $N = 8$ ) in an auditory word list lexical primed decision task, which allows processing of words and pseudowords in a speech stream. Patients with left anterior temporal lobe lesions showed no lexical N400 effect, but a delayed and reduced N400 semantic priming effect. Patients with right anterior temporal lobe lesions showed a small lexical N400 effect, but no N400 priming effect. These results indicate that the left anterior temporal lobe might play a role in initial phonetic processes during word recognition (i.e., to identify whether a word follows the phonological rules of a language), but only indirectly in semantic priming (see also McNellis & Blumstein, 2001).

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**M. BRAUN, M. DAMBACHER, & A.M. JACOBS. An ERP Investigation of the Pseudohomophone Effect in German.**

The pseudohomophone effect, i.e., the fact that pseudowords which sound like real words (e.g., FEAL) systematically yield longer processing times than spelling controls (e.g., FEEP), provides strong evidence for the idea that phonological processing is automatically involved in silent reading. The present study investigates the time course of this effect using event-related potentials (ERPs). The pseudohomophones used in this study were derived from basewords with different frequencies of occurrence to further test the frequency-sensitivity of phonological processes involved in visual word recognition. Both the behavioral and ERP data showed a pseudohomophone effect in German and also a baseword frequency effect, i.e., the pseudohomophone effect was stronger for stimuli derived from low-frequency words than for those derived from high-frequency words. The electrophysiological data suggest that this effect peaks at about 350 ms after stimulus onset. The results are discussed in the light of current computational models of word recognition.

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**Symposium 10/1:00–2:30 p.m.**

**PLASTICITY AND REHABILITATION**

**Chairs: Iris-Katharina Penner and Klaus Willmes**

**Organizer: Iris-Katharina Penner**

**Discussant: Klaus Willmes**

**I.-K. PENNER. Plasticity and Rehabilitation.**

Many neurological diseases lead to cognitive and/or motor dysfunction. As improvement of clinical status has a high impact on the quality of life for those patients, studies on neurorehabilitation have become more and more relevant. Usually, neurological readouts like reaction time or performance accuracy are used to measure the clinical status of the patient. However, these parameters provide no direct information about the anatomical or patho-physiological background of the impairment. They can just give evidence that brain function is impaired and allow to trace the progress of a disease. Moreover, the effect of therapy cannot be related to alterations in functional topography or integration. In order to understand the consequences of certain brain pathologies and to develop or improve existing therapeutical strategies it is of high relevance to explore the anatomical or biochemical background of those diseases. Recently, new imaging technologies like PET, fMRI, diffusion-tensor-imaging or high-resolution morphological scanning have been used to study the anatomical correlates of neurological impairment and the alterations induced by cognitive training. The main goal of this symposium is therefore to bring together scientists working on visualization of training effects in different neurological dysfunctions. The speakers will present interesting results on the brain's capacity to recover from cortical blindness, hemiparesis and different attention deficits due to diseases like stroke and multiple sclerosis. This symposium will give an informative but also critical overview on how therapeutic effects can be visualised by functional brain imaging.

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**R. J. SEITZ. Functional Reorganisation and Rehabilitation in Human Brain Disease.**

Stroke is a dynamic process in which ischemic brain damage is counteracted by adaptive reorganization. We are interested in identifying the role of (1) the salvable "tissue at risk", (2) the lesion development, and (3) the motor areas in the intact hemisphere for postischemic recovery. MR-measurements in more than 50 patients showed that the hyperacute perfusion deficit area is inhomogenous having a low predictive value for stroke recovery due to a variable transition into an ischemic lesion. Subsequently, brain atrophy evolves which affects perilesional and remote brain structures such as the thalamus and contralesional cortex as demonstrated with MR-morphometry. This secondary atrophy was shown to follow cerebral connectivity patterns but was not related to neurological recovery. The mechanisms underlying abnormal activations in the contralesional motor cortical areas in relation to motor activity of the recovering hand as detected with fMRI were studied with paired-pulse TMS. Results showed that the excitability of motor cortex in the non-affected cerebral hemisphere is enhanced at a higher intensity of the conditioning stimulus in recovering patients. Thus, the brain's capacity to recover from hemiparesis is not a simple function of lesion volume but involves reorganization in bihemispheric cortico-subcortical networks. Further, recovery occurring spontaneously can be modulated by rehabilitative training.

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**M. TEGENTHOFF, B. PLEGER, A.-F. FOERSTER, V. NICOLAS, & W. WIDDIG. fMRI Mirrors the Improvement of Visual Function After Repetitive Tachistoscopic Stimulation-Therapy in Patients With Cortical Blindness.**

Patients with severely reduced vision (SRV) were examined by means of fMRI before and after the application of daily visual stimulation-therapy



over a period of 6 months. Before therapy, fMRI data showed severely reduced blood-oxygen-level-dependent (BOLD) signal in primary visual cortex when compared to healthy volunteers. Following several months of rehabilitative therapy a neuropsychological improvement of visual functions was accompanied by an increase in BOLD signal of residual perilesional regions whereas fMRI data of the control group remained unchanged. A high capacity of functional recovery and synaptic plasticity of surviving perilesional neuronal structures of primary visual cortex followed by an increased input into post-connected visual areas will be discussed as a basis for the reoccurrence of visual functions.

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#### **W. STURM & K. WILLMES. Functional Reorganisation After Alertness Training in Stroke Patients.**

In patients with alertness deficits due to right hemispheric vascular brain damage training induced changes in the individual functional networks involved in intrinsic alertness were assessed in a longitudinal PET/fMRI activation study. Patients were trained by means of the alertness routine of the AIXTENT computerised attention training. Before and after the training, both PET/fMRI and a neuropsychological assessment were carried out. In the patients showing behavioural improvement, the PET/fMRI activation after training revealed a partial restitution of the right hemisphere functional network known to subserve intrinsic alertness in normal subjects, especially in the right dorsolateral or medial frontal cortex. For the patient without behavioural improvement, the PET activation after training showed an increase of activation only in the left hemisphere. In a fifth patient suffering from alertness plus chronic neglect symptoms after right hemisphere stroke, the alertness training lead to a significant improvement in neglect symptoms and to functional reorganisation during repeated activation in fMRI using a spatial orienting task.

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#### **I.-K. PENNER, M. RAUSCH, L. KAPPOS, K. OPWIS, & E.W. RADÜ. Neurorehabilitation in Multiple Sclerosis: Does Functional MRI Allow Inferences About Effectiveness?**

Currently, there is no broad consensus about the evaluation of cognitive rehabilitation in MS patients and little is known about the effects cognitive training might induce on brain organisation and its possible visualization by fMRI. We assessed three different attention domains in twelve MS patients suffering from different grades of cognitive impairment and seven healthy controls. According to the patients' performance on the tests, they were classified as mildly and severely impaired. After the baseline examination, all patients underwent a cognitive training program for the most impaired attentional function. To determine the brain structures induced by the attention tasks before and after training, all subjects were investigated with fMRI. We observed an effect of training on behavioural and imaging readouts. The most important finding was that activity in the precuneus, the posterior cingulate cortex and the dorsal frontal cortex was only observed after training, but interestingly for all three paradigms. Besides additional areas showing functional responsiveness, a relative increase in activation after training was found mainly in the frontal and parietal cortex. Hence, improved performance induced by cognitive training is reflected by an altered pattern of brain activation as visualized by MRI. Training resulted consistently in recruitment of additional brain structures. However, changes in brain activation after training were not always linked to improvement in performance. Performance gain may depend on the brain's capacity to establish new functional pathways.

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#### **Paper Session 11/1:00–2:30 p.m.**

#### **NEUROPSYCHOLOGY OF MEMORY**

##### **A. BOTZUNG, L. MANNING, C. SCHEIBER, & C. PAULO. Event-Related fMRI Study of Autobiographical Memory.**

There is a remarkable paucity in functional neuroimaging studies of autobiographical memory. Moreover, event-related paradigms resort mainly, if not only, to recognition memory. Following the preliminary implementation of an event-related self paced design, the aim of the present study was twofold: (i) to obtain a pattern of brain activation during an autobiographical memory task, in normal subjects, using their own past recollections and (ii) to investigate the likelihood of different loci of brain activation related to Tulving's Remember/Know paradigm (R/K). *Procedure:* A pool of 50 to 80 autobiographical recollections was obtained (Crovitz test). They were evenly distributed into four lifetime periods, each coded by the subject using two keywords. The fMRI assessment was subsequently carried out. Recollections corresponding to the key words presented during the fMRI session, i.e., experimental task, were contrasted with a semantic decision task. R/K judgements were obtained outside fMRI. A post-hoc selection to every scanned recollection on the basis of the R/K results was performed. Data analysis revealed the activation of a cerebral network prevailing on the left and strongly similar between the two subjects, including the posterior cingulate cortex, the prefrontal cortex, temporal cortex and parieto-occipital junction. These results are in accordance with reports on autobiographical memory as studied in PET scan and fMRI block design. Data on the R/K model paradigm are under analysis. This summarises the first part of the work. From now to June we will examine 6 further subjects: our results could provide an overture in this remarkably complex and little studied area.

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##### **C. ILSE, L. MILLER, & L. TIPPETT. Tales of Fruit and Furniture: The Sensory-Functional Theory of Semantic Memory.**

A number of cases have been reported with a selective deficit in semantic memory, where knowledge of one category (living things) is impaired, while knowledge of another category (nonliving things) is relatively spared. The opposite pattern of differential impairment has also been reported. According to the sensory-functional theory of semantic memory, this apparent categorical organization of semantic memory arises because knowledge of living things depends to a greater extent on sensory/visual attributes, and knowledge of nonliving things depends to a greater extent on functional attributes. To test this hypothesis we administered a speeded naming task, using a stimulus set comprised of 'visual' items (half living, half nonliving) and 'functional' items (half living, half nonliving), matched on picture complexity, familiarity and frequency to unilateral temporal lobectomy (TL) and control subjects. As in previous studies, the left TL group were relatively impaired naming conventional nonliving items compared to living items. However, the left TL group made significantly more errors naming functional items than visual items, while the right TL and control groups made comparable numbers of errors on both item types. Using this same set of items, there was no difference in relative accuracy naming living and nonliving items for any group. These results support the sensory-functional theory because when the relative proportion of visual and functional attributes contributing to item knowledge was controlled for, the left TL group made relatively more errors on functional items than visual items, but the categorical effect of animacy disappeared.

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##### **A.V. INGRAM, M.M. SALING, I. SCHWEITZER, C. NG, & G.R. SAVAGE. Patterns of Anterograde Memory Disturbance Associated With Three Different Types of Electroconvulsive Therapy.**

Memory dysfunction is a frequent and distressing side effect of electroconvulsive therapy (ECT). The broad pattern of post-ECT memory change

(prominent anterograde and temporally limited retrograde amnesia) is clinically different from the memory failures evident in severe depression (patchy dysmnnesia), and has been the focus of much research. Few studies evaluating post-ECT memory impairment, however, have allowed a comprehensive examination of different memory processes, such as encoding, consolidation and retrieval. Sixty depressed patients were recruited from a private psychiatric hospital. In conjunction with a battery of more traditional neuropsychological measures, the current project employed a newly developed paired associate learning test to characterize anterograde memory impairments associated with three different types of ECT in a randomized double blind design. Results from this longitudinal study, examining pre- and post-ECT memory performance, will be discussed in relation to existing neuropsychological theories of anterograde memory function.

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#### **H. WATANABE, J. KAWAGUCHI, & T. HATTA. Memory Function and Meta-Memory in Healthy Aged People.**

Memory function and meta-memory were investigated in a rural cohort in Japan. About four hundred community dwellers aged from 40 to 87 years old participated in this research survey. Participants were given two memory tasks (an explicit and implicit word memory test, and a prospective memory test) and five meta-memory questionnaires to evaluate their memory function. The results showed that explicit memory (recall) performance of words decreased over the fifties, while priming effect in implicit memory task (word-stem completion task) was shown to decline over the seventies. We will discuss the relations of these memory functions.

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#### **R. ALPITSIS, M.M. SALING, & W. LOUIS. Apolipoprotein E Status Does Not Predict Memory Decline.**

The early detection of Dementia of the Alzheimer's Type (DAT) has become increasingly important in light of recently emerging pharmacotherapeutic options. Subjects with mild cognitive impairment (MCI) have an increased likelihood of converting to DAT, but by definition these individuals are already impaired. In a 3-year longitudinal study we aimed to investigate at an earlier stage, that is, in the absence of neuropsychological impairment, the predictive capacity of the Apolipoprotein E e4 allele on future memory performance. We examined 64 subjects, 30 with the e4 allele present, and 34 with the allele absent. We administered standard neuropsychological measures, as well as the Paired Associate Learning (PAL) subtest of the Cambridge Neuropsychological Test Automated Battery (CANTAB). The latter is known to be sensitive to preclinical memory changes in DAT. The findings suggest that Apo E status does not predict future memory performance over three years, in healthy, non-depressed elderly community dwellers.

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#### **E. FUJIWARA, M. PIEFKE, S. LUX, G.R. FINK, J. KESSLER, L. KRACHT, A. DIEBEL, J. NETZ, & H.J. MARKOWITSCH. Retrieval of Autobiographical and Fictitious Episodes in Patients With Non-Organic Retrograde Amnesia.**

In three patients with non-organic retrograde amnesia, retrieval of true and fictitious autobiographical events before and after the onset of amnesia was evaluated with fMRI. 240 sentences depicting 40 episodes were presented in 6 runs. Sentences comprised true episodes before the onset of the amnesia (true-old), true episodes after onset (true-new), fictitious episodes before onset (fictitious-old), and fictitious episodes after onset (fictitious-new). There was no selective activation contrasting true and fictitious episodes regarding retrieval within the amnesic period (old) in all patients. In patient1, contrasting true-old with true-new episodes revealed clearly left lateralised activation of temporal and parietal brain

regions, while contrasting true-new with fictitious-new episodes evoked comparable bilateral activation. Patient2 showed selective right hemispheric activity in insular cortex and inferior frontal regions during true-new compared to fictitious-new episodes. In patient3, contrasting true-old with true-new episodes revealed broad activation of mainly right hemispheric regions in inferior and medial frontal cortex. Contrasting true-new and fictitious-new episodes revealed selective activation of the left cingulate. We presume from the left-hemispheric temporal-parietal activation seen in patient1 that true episodes within the amnesic period were processed in an unemotional, semantic manner. The same contrast in patient3 revealed significant right-hemispheric frontal activation indicating episodic retrieval mode and high retrieval effort. Activation of the right frontal cortex in patient2 while confronted with true-new contrasting fictitious-new episodes may reflect successful episodic retrieval of truly experienced events after the onset of amnesia. Results are discussed regarding the patients' neurological and psychiatric characteristics.

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### **Paper Session 12/1:00–2:30 p.m.**

#### **LATERALIZATION**

#### **K. HARTMANN, M. DAUMÜLLER, J. HERMSDÖRFER, & G. GOLDENBERG. Complex Activities of Daily Living and Mechanical Problem Solving in Left Brain Damage.**

Disturbed performance of everyday action in patients with left brain damage (LBD) is traditionally considered a manifestation of "ideational apraxia". Nevertheless, there may be different cognitive components of object use contributing to performance on such tasks. Knowledge about functional properties of familiar objects and the ability to infer function from structure have been found to depend on left hemisphere integrity. Complex mechanical problems pose additional demands on planning ahead and action sequencing. We examined these components of object use in LBD-patients and compared them to RBD-patients and healthy controls. For assessing complex mechanical problem solving subjects were given three models of a "treasure box". Patients had to find out how to manipulate different bolts and locks and how to sequence steps to open them. Inferring function from structure was assessed by the "novel-tool-test". Functional semantics were tested by matching pictures of objects according to their functional relationships. Finally, subjects performed two complex everyday tasks: making coffee (familiar) and using a tape recorder (unfamiliar). While in some domains only LBD-patients showed deficits (functional semantics, inferring function from structure), both LBD- and RBD-patients were impaired in complex mechanical problem solving. In LBD-patients, the best predictor for the coffee task was functional semantics, while the tape recorder showed strongest correlations with complex mechanical problem solving. Our results show that different components of object use contribute to performance on everyday action. While these components differ in their sensitivity to left and right brain damage, their significance for performance on everyday tasks depends on familiarity of the tasks.

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#### **P. BRUGGER & M. REGARD. Unilateral Brain Lesions: "Destiny" on the Left and "Chance" on the Right?**

The term "cerebrovascular accident/incident" reminds us of the close conceptual links between the notion of chance and unpredictability and that of illness and health. In view of functional hemispheric asymmetries in the appreciation of (1) personal relevance as opposed to "anonymous chance" and (2) one's own health state, we investigated the attitude of patients with unilateral brain lesions (about half vascular, half space-occupying) toward their illness. There were 45 patients with focal, mainly

cortical left (LH) lesions (21 women) and 48 (23 women) with lesions to the right hemisphere (RH). The two groups were matched with respect to age and education. All patients were asked to spontaneously write one sentence containing the words "I" and "chance" (task disguised as a test of one's writing ability). Sentences were dichotomized with respect to (1) whether or not allusion was made to the present illness, and orthogonally (2) whether chance was acknowledged or rejected. The LH-lesioned patients acknowledged chance as long as they did not make allusion to the own illness ("I have met my aunt by chance"; 86.1%), but rejected it when such allusion was present ("It's not chance that I turned ill"; 44.4%;  $\chi^2 = 4.2$ ,  $p < .05$ ). RH-lesioned patients showed no interaction between reference to their own illness and attitude toward chance. Thus, whereas LH lesions are ascribed to some non-chance origin, RH-lesioned patients rather tend to an interpretation in terms of chance. We discuss these results with reference to anosognosia, i.e., the inability, more frequently observed after RH damage, to acknowledge one's own disease. Correspondence: *Peter Brugger, Dept. of Neurology, University Hospital Zurich, CH-8091 Zurich, Switzerland. E-mail: pbrugger@npsy.unizh.ch*

**M.C. CORBALLIS, P.M. CORBALLIS, & M. FABRI. Perceptual Dissociations in a Split-Brained Man.**

DDV is a man who underwent two-stage callosotomy, completed in 1994, for the relief of epilepsy. When asked to press a key to flashes of light, he shows almost total neglect of flashes in the left visual field (LVF), but responds much more quickly to flashes in the right visual field (RVF) when a flash is also presented in the LVF. When asked to decide by key presses whether pairs of flashed lights are the same or different in color, he responds perfectly if both are in the RVF and at chance if they are in opposite fields, but completely ignores them if both are in the LVF. This LVF neglect disappears in tasks involving pointing rather than key-presses. Thus he easily responds to flashes in either visual field by pointing to their location. He correctly indicates, by pointing, the direction of a bar-motion illusion in either visual field, and is well above chance in indicating the direction of induced bar motion in either visual field when the inducing stimulus is in the opposite field. The pattern of perceptual performance is consistent with the theory that DDV's dorsal visual system is largely intact and connected interhemispherically, presumably at a sub-cortical level, but that his ventral system is divided, with conscious detection largely confined to the RVF and left hemisphere.

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**H. LAUSBERG, R.F. CRUZ, S. KITA, E. ZAIDEL, & A. PTITO. Pantomime to Visual Presentation of Objects: Left Hand Dyspraxia in Patients With Complete Callosotomy.**

Investigations of left hand praxis in imitation and object use in patients with callosal disconnection have yielded divergent results inducing a controversial discussion between two theoretical positions. While Liepmann suggested that the left hemisphere is motor dominant, others maintain that both hemispheres have equal motor competences and propose that left hand apraxia in patients with callosal disconnection is secondary to left hemispheric specialization for language or other task modalities. The present study aims to gain further insight into the motor competence of the right hemisphere by investigating pantomime of object use in split-brain patients. Three patients with complete callosotomy, and as control groups, five patients with partial callosotomy and nine healthy subjects were examined for their ability to pantomime object use to visual object presentation and demonstrate with object manipulation. In each condition, eleven objects were presented to the subjects who pantomimed or demonstrated the object use with either hand. In addition, six object pairs were presented to test bimanual coordination. Two independent raters evaluated the videotaped movement demonstrations. While the object use demonstrations were perfect in all three groups, the split-brain patients displayed apraxic errors only with their left hands in the pantomime condition. The movement analysis of concept and execution errors included the examination of ipsilateral *versus* contralateral motor control. As the right hand/left hemi-

sphere performances demonstrated retrieval of the correct movement concepts, concept errors by the left hand were taken as evidence for right hemisphere control. Several types of execution errors reflected a lack of distal motor control indicating the use of ipsilateral pathways. While split-brain patient AA controlled his left hand predominantly by ipsilateral pathways in the pantomime condition, the error profile in GC and NG suggested that the right hemisphere controlled their left hands. In the object use condition, in all three split-brain patients, fine-grained distal movements in the left hand indicated right hemispheric control. Our data clearly show left hand apraxia in split-brain patients is not limited to verbal commands but also occurs in pantomime to visual presentation of objects. As the demonstration with object in hand was unimpaired in either hand, both hemispheres must contain movement concepts for object use. But, the separate right hemisphere is impaired in retrieving the movement concept in response to visual object presentation, presumably because of a deficit in perceptual object representation and/or its association with the movement concepts.

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**J.M. KAUFMANN & S.R. SCHWEINBERGER. Interhemispheric Cooperation for Face Processing.**

We investigated interhemispheric cooperation for face processing as indicated by enhanced performance when stimuli are presented to both visual fields relative to one visual field alone. This "bilateral gain" is seen for words but not pseudowords in lexical decision tasks, and has been attributed to the operation of interhemispheric cell assemblies that exist only for meaningful words with acquired cortical representations. Recently, a bilateral gain has been reported for famous but not unfamiliar faces in a face recognition task (Mohr et al., 2002, *Neuropsychologia*, 40, 1841-1848). Our participants performed familiarity decisions for faces that were presented to the left (LVF), the right (RVF), or to both visual fields (BVF). An advantage for BVF relative to both LVF and RVF stimuli was seen in reaction times (RTs) to famous faces, but not to unfamiliar faces. When participants classified the expression (happy or neutral) of unfamiliar faces, no bilateral advantage was seen, although a right hemisphere superiority was present in terms of higher accuracy for LVF and BVF trials relative to the RVF. Recognition of famous faces (but not of facial expressions) requires access to acquired memory representations that may be instantiated via cortical cell assemblies, and it is suggested that interhemispheric cooperation depends on these acquired cortical representations. Further experiments will be reported that are aimed at studying the nature of these cell assemblies in more detail.

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**Symposium 11/3:00-4:30 p.m.**

**LOOPS, LINKS, AND LESIONS:  
THE SIGNIFICANCE OF SUBCORTICO-CORTICAL  
CIRCUITS FOR HUMAN BEHAVIOR**

**Organizer and Chair: T. Benke**

**T. BENKE. Loops, Links, and Lesions: The Significance of Subcortico-Cortical Circuits for Human Behavior.**

A growing number of lesion and functional imaging studies highlights the role of subcortical structures in human cognition and behavior. Thus, contrary to the original concept of higher mental functions being confined to the cortex, recent findings suggest that other subcortically localized structures contribute essentially to cognitive functions and also mediate several aspects of behavioral control. Evidence comes from patients with



vascular lesions, neurodegenerative and developmental disorders, but also from neuropsychiatric disorders such as schizophrenia, obsessive compulsive disorders and depression, and from studies of cognitive aging. The symposium, Loops, links, and lesions takes the view that the mechanism of behavioral impairment associated with subcortical lesions is strongly related to the neuroanatomy and pathology of subcortico-cortical circuits which appear to be one of the principal organizational networks of the brain. Clinical and experimental data are presented to further delineate the role of the basal ganglia, cerebellum, brainstem, and basal forebrain nuclei in cognitive domains such as language, memory, executive control, and awareness. Furthermore, anatomical models will be presented to discuss the interaction between subcortical nuclei and the cortex, and the effect of lesions on the functional organization of subcortico-cortical circuits.

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#### **I. DAUM, K. HEYDER, B. KOCH, & M. SCHWARZ. Executive Dysfunction After Selective Cerebellar and Frontal Lesions.**

The cerebellum and the prefrontal cortex are embedded in a cortico-subcortical circuit which is involved in the mediation of executive functions. The nature of the contribution of each component to different aspects of executive control is as yet unclear. The aim of the present study was to identify the differential role of the cerebellum and the prefrontal cortex in two components of executive function, inhibition and multitasking. Patients with selective vascular lesions of the cerebellum and the prefrontal cortex completed a range of clinical executive function tasks, a multitasking test involving the coordination of location and shape decisions and a continuous performance test including a response inhibition condition. Cerebellar patients showed verbal fluency deficits and variable performance on inhibition and multitasking, whereas frontal patients showed pronounced impairments on clinical tests as well as set formation deficits and increased error rates on inhibition trials. This pattern indicates specific inhibition deficits after frontal damage.

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#### **C.W. WALLESCHE. Loops, Lesions, and Language.**

A participation of subcortical nuclei in language functions has been proposed for more than a century, but is still being debated. I shall present various historical (e.g., Penfield) and recent theories (e.g., Nadeau & Crosson) and will try to integrate clinical and imaging data into the neuro-anatomical model of Alexander et al. (1986).

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#### **A. SCHNIDER. Subcortical Participation in Reality Monitoring.**

The orbitofrontal cortex (OFC) and the basal forebrain have long been known to participate in the encoding of new information, a notion underscored by imaging studies in healthy subjects. Recent studies in patients producing spontaneous confabulation indicate, however, that the posterior medial OFC has another, distinct role for memory processing: the adaptation of thought to ongoing reality. It appears to achieve this by suppressing (de-activating) at all times those mental associations that do not pertain to ongoing reality (Schnider & Ptak, (1999). *R. Nat. Neurosci.*, 2, 677–681). This suppression appears to occur even before the content of a memory is consciously recognized (Schnider et al., (2002). *Cereb. Cortex*, 12, 54–61). Using a similar, but more powerful, paradigm as in an earlier PET study (Schnider et al., (2000). *J. Neurosci.*, 20, 5880–5884), we found that the OFC exerts this suppression of currently irrelevant memories through subcortical connections comprising the ventral striatum, caudate nucleus, substantia nigra, and contralateral medial thalamus. These structures are known to be part of a cortico-subcortical loop, which is modulated by the dopaminergic reward system. A comparison with animal experiments suggests that the adaptation of thought to ongoing reality is a distinct facet of this system, and that in human thinking, the notion of “reward” has to be

extended to the achievement of goals and satisfaction of expectations in general.

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#### **T. BENKE. Behavioral Abnormalities in Peduncular Hallucinoses.**

Peduncular hallucinosis (PH) is a brainstem syndrome whose neurobehavioral features have not been studied systematically. Moreover, the role of brainstem structures in human cognition and behavior is poorly specified. Five premorbidly nondemented patients with PH were investigated in a prospective study. Patients had suffered acute vascular, focal lesions in the midbrain, thalamus, pedunculi or pons. Hallucinations were vivid, mostly visual or complex, often stereotypically recurrent, and were perceived as absolutely genuine. Psychometric testing revealed that all patients had a prominent amnesic syndrome and an impairment of executive functions. Other behavioral abnormalities included spontaneous confabulations, delusional misidentification, reduplicative phenomena, and reduced disease awareness. These findings suggest that upper brainstem lesions may cause severe impairments of cognition and behavior, including a loss of reality monitoring. It seems likely that these behavioral abnormalities originate from an interruption of subcortico-cortical circuits, pathways linking the cerebellum and forebrain, and the ascending reticular formation.

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### **Symposium 12/3:00–4:30 p.m.**

#### **ADVANCES IN THE ASSESSMENT OF ATTENTION AND EXECUTIVE FUNCTION IN CHILDREN: IMPLICATIONS FOR CLINICAL PRACTICE**

**Organizer and Chair: Vicki Anderson**

**Discussant: Ian Robertson**

#### **V. ANDERSON. Advances in the Assessment of Attention and Executive Function in Children: Implications for Clinical Practice.**

Until recent years, child-specific neuropsychological evaluation and diagnosis has been limited by inappropriate, poorly standardised assessment tools. Today, there are a number of promising new measures emerging that provide the opportunity to improve clinical practice and diagnostic accuracy. This symposium aims to explore these new measures in the context of both normal and abnormal child development. The symposium has three general aims: (i) to emphasise the importance of employing developmentally appropriate theory and methodology for child neuropsychology; (ii) to discuss new measures of attention and executive function appropriate for use in child populations; and (iii) to explore the significance of these techniques for clinical practice, in particular diagnosis and intervention.

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#### **D. SMIDTS, R. JACOBS, & V. ANDERSON. Developmental Trajectories for Executive Skills in Preschool Children.**

In recent years our knowledge of executive processes in preschoolers has expanded significantly, alongside the increase in assessment measures available for young children. Executive function encompasses both cognitive and behavioral elements, which appear to develop rapidly during childhood and adolescence. The present study was designed to investigate the development of executive functions in young children between the ages of 3 and 7 years. To do this, a wide range of measures was employed, including both existing and newly developed tests, and tapping both cog-

nitive and behavioral dimensions of executive function. The sample consisted of 100 normal children, recruited from metropolitan child care centers and schools. Findings revealed varying developmental trajectories for a number of executive processes. In particular it was found that developmental patterns for basic cognitive processes (e.g., classification skills, inhibition of responses) were relatively mature by age 7 years and preceded the development of more complex abilities (e.g., cognitive flexibility, problem solving). This presentation will explore the implications of these findings for current clinical assessment and diagnostic practices.

Correspondence: *Diana Smids, Department of Psychology, University of Melbourne, VIC 3010, Australia.*

**M. KORKMAN & S. KEMP. Comparison of Attention and Executive Function Test Scores of Children With ADHD, Reading Disorder, and Autism.**

Children with ADHD and high-functioning autistic children are known to have specific types of impairment of attention and executive functions. In contrast, these problems are not characteristic of children with reading disorder (RD) although there is a tendency for comorbid problems. This study examined the test profiles across eight tests representing attention and executive functions in children with ADHD, RD, and autism. Subjects aged 5 to 12 years were drawn from the pertinent validation studies performed for the publication of the NEPSY. Group frequencies were ADHD:  $N = 51$ ; RD:  $N = 36$ ; high functioning autistic:  $N = 21$ . The tests included measures of the following type: a test of auditory selective attention, a test of visual selective attention, two tests of inhibition and control, a verbal fluency test, a design fluency test, a tower test, and a list learning test. The overall difference in test profile was very significant according to a repeated measures ANOVA ( $p < .001$ ). The children with ADHD were characterized by impairments on the two subtests representing inhibition and control as well as on the list learning subtest, whereas the children with RD were impaired on the verbal fluency and the list learning subtest. The autistic children exhibited impairments across all subtests except the two subtests measuring selective attention. The results suggest that attention and executive functions are differentially affected in the three diagnostic groups so that children with ADHD are characterized by impairment of inhibition and control as well of effortful learning. Children with autism are characterized by widespread impairments but a strength in selective attention. Children with specific RD do not seem to have impairment of attention or executive functions with the exception of problems secondary to verbal impairment.

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**T. MANLY & V. DOBLER. Developmental Unilateral Neglect.**

Unilateral spatial neglect, a difficulty in detecting or acting on information from one side of space, is a striking and relatively common consequence of stroke in adulthood. Although most patients recover quite quickly, chronic spatial bias is overwhelmingly associated with right hemisphere lesions, affects left space, and is often accompanied by more generalised non-spatial attentional deficits. The question we address here is whether another group in which poorly maintained arousal and attention are common may also be vulnerable to such spatial bias. We present two case studies of boys diagnosed with attention deficit hyperactivity disorder who, despite having suffered no brain damage or sudden onset to their difficulties, and in the context of good to above average verbal abilities, showed a neglect for left space equal in magnitude to that seen in many brain injured adults. The links to the adult disorder are further supported by the observed reductions in neglect in the context of left-limb movement and external alerting techniques. Screening normal and clinical samples using the Test of everyday Attention for Children (TEA-Ch), suggests that links between sustained attention deficits and an attentional bias away from left space are more widespread in childhood. Clinical implications in terms of assessment and rehabilitation are discussed.

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**V. ANDERSON & C. CATROPPA. Attention Skills Following Head Injury in Preschool Children.**

Attentional difficulties are common following traumatic brain injury (TBI) in childhood. However, assessment of these deficits is often confounded by related skills, including speed of processing and executive functions. This study attempted to isolate attentional skills from these functions, using manipulations of the continuous performance paradigm, a method commonly used in the assessment of attention. The study examined sustained attention abilities 24 months post-injury, in three groups of children who had suffered TBI in early childhood: (i) mild TBI ( $n = 24$ ); (ii) moderate TBI ( $n = 31$ ); and (iii) severe TBI ( $n = 14$ ). Three manipulations of the Continuous Performance Test paradigm (CPT) were employed in the study, to delineate factors that might influence CPT performance, including speed of processing, attentional lapses and stimulus complexity. No significant differences were evident among the TBI groups on a measure of simple reaction time, nor on a CPT version where the inter-stimulus interval was lengthened. However, there was a significant difference between the mild and severe TBI groups on the most complex task, which required speed, accuracy and decision-making, suggesting that these factors underlie impaired performances previously identified on the CPT in children with severe TBI. These findings have implications for the development of intervention programs for these children.

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**Paper Session 13/3:00–4:30 p.m.**

**OUTCOME RESEARCH**

**B. BENZ, A. RITZ, S. GEBBE, & C. SCHWERMER. Long-Term Effects of Early Traumatic Brain Injury (TBI) on Neuropsychological Functions.**

*Introduction:* Recent studies of long-term neuropsychological outcome after pediatric TBI point to an increased risk for cognitive impairment associated with early age at injury. *Subjects and Method:* 145 former patients, treated after childhood TBI in a neurological rehabilitation center, were reexamined at the age of 16–23 years. Means were 9.4 ( $\pm 2.3$ ) years for age at injury and 9.95 ( $\pm 3.3$ /minimum 3 yrs) for time post trauma. Ninety-four percent of the sample were classified as severe TBI ( $GCS = 8/PTA \geq 24$  hrs). Neuropsychological domains (i.e., verbal and visual memory, executive functions) were represented by composite scores. *Results:* Despite overall very satisfactory test performance, significant effects of injury severity and age at trauma persisted in the clinical sample when both variables were taken into account. When divided into 2 groups with moderate/severe versus very severe TBI, within each group subjects who had been younger at the time of trauma (2–8 vs. 9–15 yrs) scored significantly lower in all neuropsychological domains. For linguistic skills and executive functions, effects of age at trauma exceeded those of trauma severity. Level of executive functioning at follow-up as a selection criterion divided two extreme groups with good versus severely impaired neuropsychological profiles. On the time axis, single subjects showed patterns of “growing into a deficit”. *Conclusions:* Age at trauma is an important variable with substantial impact on long-term development for the survivors of childhood TBI. The data emphasize the importance of executive functions for learning and mastery of complex skills.

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**L. HIMANEN, R. PORTIN, H. ISONIEMI, T. KURKI, V. KAIRISTO, & O. TENOVUO. Executive and Memory Functions, MRI-Measures, and APOE4 in Traumatic Brain Injury Patients: 30 Year Follow-Up Study.**

*Objective:* The aim of this study was to evaluate the effects of a very old traumatic brain injury (TBI) on cognitive performances and their associations with MRI measures, the apoE4 allele and injury severity. *Method:*

Sixty-one patients were assessed on average 30 years after TBI. A comprehensive neuropsychological test battery was used to evaluate memory and executive functions in particular. Multiple regression analyses were used to explore the relationships between cognitive variables and the severity of injury, MRI measures and the apolipoprotein 4 allele. The analyses were adjusted for by age, education and gender. *Results:* There were many associations between cognitive and other measures. MRI volumetric reductions were associated with impaired episodic memory ( $p < .001$ ,  $p = .043$ ), memory complaints ( $p = .032$ ) and difficulty on the Wisconsin Card Sorting Task ( $p = .004$ – $.047$ ). Contusion findings on MRI were associated with impaired associative learning ( $p = .008$  and  $p = .042$ ). The apolipoprotein 4 allele was related to overall deterioration ( $p = .011$ ) and the Benton Visual Retention Test ( $p = .024$ ) and also to attentional performance requiring working memory and information processing speed ( $p = .009$ ). The best predictor for the cognitive outcome was the volume of the lateral ventricle. There was only a modest relationship between the severity of injury and cognitive performance. *Conclusions:* Our results suggest that TBI may cause persisting cognitive impairments and alter the age-related cognitive changes. Memory impairments are associated with MRI volumetric measures and the APOE 4 allele, and seem to increase risk for long-term overall deterioration and reduced information processing speed.

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**K. JODZIO, D. GASECKI, D.A. DRUMM, P. LASS, S. LENART, & W.M. NYKA. Regional Cerebral Blood Flow SPECT Studies of Recovery in Aphasia.**

Neural mechanisms underlying recovery from aphasia are incompletely understood. The present studies examined the correspondence between post-stroke recovery from aphasia as measured by selected tasks derived from the Boston Diagnostic Aphasia Examination (BDAE) and changes in cerebral blood flow (CBF) as measured by single-photon emission computed tomography (SPECT). For the prospective study, 20 right-handed patients (mean age  $58.5 \pm 12.8$ ) with acute aphasia (approximately 2 weeks post-onset) were examined twice with a 6-month interval. Both BDAE and SPECT were performed. The increase in perfusion of the right thalamus was found to parallel the recovery of aphasic disorders. Improvement in language functions were positively correlated with the mean right hemispheric CBF found on the second examination. In the retrospective study, 30 right-handed aphasics (mean age  $57.6 \pm 12.2$ ) received a BDAE battery and SPECT at a mean of 12 months after onset. An initial language evaluation was completed 6 months earlier. The patients were divided into two groups with either a good or poor recovery based on the change (improvement) in the BDAE total score. The left hemisphere CBF was higher in the patients with good recovery, while the CBF on the right did not differ significantly between groups. These results support the hypothesis of a right hemisphere contribution only to the early recovery from aphasia, whereas subsequent remission of language deficits may be related to compensatory functions in the left hemisphere, specifically in the temporal, parietal and thalamic areas.

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**K. FRENCHAM, A. FOX, & M. MAYBERY. Long-Term Effects of Mild Traumatic Brain Injury on Immediate Memory, Processing Speed, and Psychosocial Functioning.**

When assessed more than 6 months post injury, most individuals who have experienced a mild traumatic brain injury (TBI) report resolution of cognitive and psychosocial sequelae, however a subgroup may experience ongoing difficulties. While neuropsychological assessment has been criticised as being insensitive to commonly reported cognitive deficits in this population during the acute phase and long-term follow-up, tests such as the Kaufman Hand Movement Test have been shown to be sensitive to mild TBI. Recent dual task investigations of memory for hand movements in a non head injured population found that performance was more re-

duced by articulatory suppression than spatial or movement interference, supporting the possibility of a verbal strategy enhancing recall of movement sequences. In the present study 26 individuals who reported a mild TBI within the past 5 years were compared to 26 matched controls. A letter span, hand movement span and Corsi span task were administered under no interference and articulatory suppression conditions. Participants were also administered tasks of processing speed, premorbid intelligence and questionnaires assessing psychosocial and emotional functioning. While there were no differences on the cognitive measures compared to the control group, the mild TBI group endorsed more difficulties with alertness and reduced involvement in recreation and pastimes. Thus persistent difficulties after mild TBI tend to relate to psychosocial variables, despite intact cognitive performance.

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**D. WIESNER, V.F. MAUTNER, & R.A. LEARK. Cognitive and Psychosocial Functioning of NF1 Adults With and Without History of ADHD.**

Few studies have reported on the effect of attention problems in adults with neurofibromatosis type 1 (NF1). The responses of three groups of German adults were examined: adults with NF and no reported histories of problems with attention ( $n = 23$ ); adults with NF who had positive histories of problems with attention in childhood ( $n = 21$ ); and adults without NF who had positive histories of problems with attention in childhood ( $n = 42$ ). NIH criteria for NF1 were used and subjects were tested with German normed tests. An ANOVA yielded significant differences between the three groups on measures of intelligence (HAWIE-R) for the three global scores of FIQ, VIQ and PIQ. Post-hoc analysis found non-significant differences between the two groups of adults with NF1, indicating histories of attention did not produce changes on IQ testing. On emotional function measures (FPI-R), the ANOVA yielded significant differences on nine out of 12 scales of the FPI-R. Post-hoc analysis confirmed subjects with attention problems reported poorer emotional functioning. On a measure of psychosocial functioning (FLZ), the ANOVA yielded between group differences on three of eight scales. Post-hoc analysis found the two groups with attention problems reported poorest functioning. The data suggests that NF1 adults with attention problems performed reported more interpersonal distress and poorer psychosocial functioning. Severity of disfigurement was not found to be related. The results confirm findings reported in NF1 children's literature indicating life long clinical features that require continued care. Suggestions for treatment are provided.

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**S. YANIV, Y. AHARON-PERETZ, & R. TOMER. CTX-Effectiveness of Pharmacological Treatment Assessed by Neuropsychological Measures.**

The neuropsychological profiles of two sets of siblings diagnosed with CTX (cerebrotendinous xanthomatosis) are presented, with the initiation of treatment and 12 months later. CTX is a very rare lipid storage disease caused by a deficiency of a mitochondrial enzyme, due to gene mutations. The clinical symptoms of CTX develop during the second decade of life and include juvenile cataracts, peripheral neuropathy, abnormal EEG and cognitive impairment. The four patients were referred for neuropsychological evaluation shortly after diagnosis and they all started treatment with chenodeoxycholic acid and simvastatin. The first set of siblings consisted of (a) an 18 year old male, with poor early development, and a long standing learning disorder and borderline intelligence, who quit school at 16 years old and (b) a 16 year old female, with initial normal development, followed by gradual cognitive decline, integrated in a regular, albeit low level, high school. The second set of siblings consisted of (a) an 18 year old male, with poor early development, a long standing learning disorder and mild retardation, referred to Special Education but finishing regular



high school without a diploma and (b) a 15 year old female, normal early development, followed by gradual cognitive decline, who was integrated in regular high school but low functioning. A comprehensive neuropsychological battery was administered twice, at 12 month intervals. The results one year after treatment initiation indicated some degree of cognitive improvement in all four patients. The improvement was more dramatic in the female patients than in their male siblings and it concentrated in the learning/memory and the visual/spatial domains. In two patients improvement also occurred in a general intelligence measure (Raven Matrices), which may be attributed to the improved visual/spatial functioning. Correspondence: S. Yaniv, *The Cognitive Neurology Unit, Rambam Medical Center, PO Box 9602, 31096 Haifa, Israel. E-mail: yanivs@rambam.health.gov.il*

### Paper Session 14/3:00–4:30 p.m.

#### NEURODEGENERATIVE DISORDERS AND DEMENTIA II

##### **E.D. BIGLER. Traumatic Brain Injury, Normal Aging, and Dementia: Hippocampal Atrophy as the Putative Basis for a Relationship.**

**Background and Purpose:** To demonstrate that hippocampal atrophy brought on by traumatic brain injury (TBI) sets the stage for accelerated volume loss with aging that will match the typical volume loss found in dementia [Alzheimer disease (AD) and vascular dementia (VaD)] at an earlier age. **Methods:** Three cohorts [normal aging, TBI and dementia (AD and VaD subjects combined)] were taken from three studies all from the same laboratory using similar ANALYZE® segmentation methods to quantify hippocampal volume. Total hippocampal volume in the dementia subjects was based on a total of 105 ( $M = 39$ ,  $F = 66$ ) AD and VaD subjects. Normal aging effects on hippocampal volume from age 16 to 87 in non-demented normal subjects ( $N = 172$ ;  $M/F = 82/90$ ) were plotted, where the average volume loss by age was best fit by a polynomial curve. A group ( $N = 98$ ;  $M/F = 69/29$ ) of 16–35 year old TBI patients was compared and the quadratic function of normal aging superimposed. **Results:** A linear fit was associated with hippocampal volume loss from age 15–35 in TBI subjects. In the TBI subjects, taking the end point of that linear regression line at age 35 and superimposing the polynomial from the normal aging cohort, the projected hippocampal volume in TBI subjects approximated hippocampal volume in the dementia cohort nearly 20 years earlier. **Conclusion:** TBI that results in hippocampal atrophy may set the stage for accelerated hippocampal volume loss with aging.

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##### **D. CAINE, P. NESTOR, & J.R. HODGES. Visual Variant AD: A Disorder of Dorsal Stream Processing?**

Although recognized for some years, the syndrome of visual variant Alzheimer's disease (VAD) has not been previously investigated using a consistent battery of neuropsychological tasks informed by current concepts of differential visual processing streams across a series of cases. Our aim was to characterize the spatial and visuo-perceptual abilities of nine patients presenting with prominent visual symptoms as the first sign of VAD. All nine patients underwent tests of early visual processing including tests of acuity, contrast sensitivity, shape and colour recognition, spatial vision, object recognition, semantic memory, visual and auditory attention, as well as MRI and FGD-PET imaging. All patients performed relatively well on verbal semantic tasks and could correctly identify prototypical views of both line drawings and photographs of objects. By contrast, all showed marked impairment in higher order visuospatial processing. A subgroup of patients also had features of a Balint's syndrome, including simultanagnosia. This subgroup showed deficits on tests of object constancy such as recognition of misoriented objects. Thus all of the patients had predominantly dorsal rather than ventral visual deficits, but some had more prominent posterior occipitoparietal dysfunction while others had

more purely parietal problems. We conclude that the majority of patients with PCA have severe breakdown of dorsally based visuospatial processing. The intact recognition of objects when viewed from a conventional viewpoint but impairment at recognizing misoriented objects raises issues concerning the role of ventral *versus* dorsal visual streams in such tasks. Correspondence: Diana Caine, School of Psychology, Transient Building F12, University of Sydney, Sydney, NSW 2006, Australia. E-mail: dianac@psych.usyd.edu.au

##### **B. CASEY, G.A. BROE, & M. FULHAM. Repetitive Behaviours in Fronto-Temporal Dementia and Regional Metabolic Activity on PET.**

Repetitive, stereotypic and compulsive behaviours are relatively common in Fronto-Temporal Dementia (FTD), although there is considerable variation between patients in the nature of these behaviours. FTD is also characterised by a relatively high prevalence of degeneration of the head of the caudate nucleus. The caudate nucleus participates with several frontal regions in functional circuits. A number of glucose-PET studies have reported increased caudate metabolic activity in psychiatric patients with idiopathic Obsessive Compulsive Disorder (OCD). Despite differences in the nature of OCD behaviours and the compulsive behaviours seen in FTD (notably the fact that anxiety reduction plays an important role in driving the former) we also found increased caudate metabolism in compulsive FTD patients compared with those without compulsive behaviours. According to Denny-Brown (1958) and Lhermitte (1983), environmentally triggered stereotypic behaviours (such as forced object utilisation) might arise as a result of an imbalance between frontal and parietal activity, with damaged frontal lobes failing to exercise their normal modulatory and inhibitory influence on environmentally responsive parietal systems, which are able to initiate automatic responding unchecked. When FTD patients exhibiting environmentally dependent behaviours were compared with those without such behaviours, we indeed found that they differed in the ratio of orbito-frontal to parietal metabolic activity on glucose-PET.

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##### **M.A. FEARING, E.D. BIGLER, K.D. GARRETT, J. TSCHANZ, & K.A. WELSH-BOHMER. Neuroimaging Correlates of the Mini Mental State Exam and IQCODE in Dementia.**

**Background and Objectives:** The Mini-Mental State Exam (MMSE) is the most widely used brief screening instrument in dementia research. Patients unable to complete the MMSE, or with profound impairment can be assessed with the Informant Questionnaire on Cognitive Decline in the Elderly (IQCODE). In this study we examined the relationship between poor performance on the MMSE, IQCODE, and neuropathological changes as determined by quantitative MRI. **Methods:** Participants were drawn from the Cache County Study of Memory and included subjects with Alzheimer disease ( $n = 85$ ), vascular dementia ( $n = 21$ ), and a group with mixed neuropsychiatric disorders ( $n = 39$ ). Participants were divided into two groups, moderate-to-severely impaired and those with mild to moderate impairment. Volumes of the total brain, total temporal lobe (TTL), hippocampus, and whole brain ventricle-to-brain ratio (VBR) were obtained and compared in these groups. Additional stepwise multiple regression analyses were conducted as well. **Results:** The group with the lowest MMSE performance had greater atrophy in all brain regions analyzed including TTL ( $F = 15.93$ ,  $p < .05$ ), hippocampus ( $F = 3.51$ ,  $p < .05$ ), total brain ( $F = 8.40$ ,  $p < .05$ ), and VBR measures ( $F = 14.50$ ,  $p < .05$ ). Furthermore, poor performance on the MMSE and IQCODE related similarly to the degree of atrophy. For example, for the low MMSE group, the correlation between TTL volume and MMSE scores was .35 ( $p < .02$ ) and the correlation of IQCODE with TTL volume was  $-.39$  ( $p < .004$ ). Lower scores on the IQCODE are reflective of more intact functioning, hence the negative correlation. **Conclusions:** Subjects with the lowest MMSE scores demonstrated the greatest atrophy compared to those with higher scores. Performance on the MMSE and informant ratings of change in cognitive functioning both demonstrated modest correlations with TTL volume. These results suggest that in the moderate stages of dementia the

two approaches to dementia screening and staging (in person vs. informant report) perform similarly and in predictable ways with respect to brain atrophy. The findings may have utility in studies which track dementia progression over time, where in person assessment becomes more difficult as the dementia progresses.

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**C.J.G. LANG, P. BALAN, J. BLUNK, & J.G. HECKMANN. Neuropsychological Deficit Screening—Useful for Dementia Screening Too?**

To assess the psychometric features of the Neuropsychological Deficit Screening (NDS), originally designed to screen for neuropsychological impairments in a psychiatric population, for detection of dementia, three groups of patients (demented,  $N = 41$ ; not demented, but cognitively impaired,  $N = 23$ ; controls,  $N = 50$ ) were examined and the results compared with two well established tests, the Mattis Dementia Rating Scale (MDRS) and the Mini Mental Status Examination (MMSE). Dementia was diagnosed according to ICD-10 and DSM-IV criteria. Using a receiver operant characteristic (ROC) curve to assess the discriminative power between demented and controls, the area under the curve (AUC) was as high as .966, and only slightly surpassed by the two other tests, but not significantly different from them. Results were expectedly less favorable when comparing cognitively impaired patients to demented patients and controls ( $AUC = .720$ ). Sensitivity and specificity were .976 and .860, respectively. The test characteristics did not change considerably if the procedure was shortened using the most selective subtests only. Adopting a two stage procedure (memory testing first) yielded no advantage. Summarizing, the discriminating power of the NDS was comparable to both other tests without surpassing them, neither if the selection of demented nor cognitively impaired patients was considered. Test administration lasted about 23 minutes. An abbreviated version cut it in half and allowed for an improved economy without sacrificing discriminating properties. The advantage of the NDS thus lies in its diversity of functions assessed, while its screening power is comparable to the MMSE and MDRS.

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**K.R.A. VAN DIJK, E.J.A. SCHERDER, Ph. SCHELTENS, H.C. WEINSTEIN, & J.A. SERGEANT. Effects of Transcutaneous Electrical Nerve Stimulation (TENS) on Circadian Rhythm Disturbances in Alzheimer's Disease.**

Rest-activity rhythm disruption is a frequent symptom of Alzheimer's disease (AD) and places an enormous burden on the partner of a patient. Circadian rest-activity rhythm disturbances in AD are thought to result from degeneration of the hypothalamic suprachiasmatic nucleus, the biological clock of the brain. It is argued that through direct spinohypothalamic pathways Transcutaneous Electrical Nerve Stimulation (TENS), a type of peripheral nerve stimulation, might stimulate this biological clock. Previous research concerning TENS in AD has shown positive effects on cognition, behaviour, and on the sleep-wake cycle in institutionalised AD patients. The present study examined the effects of TENS when applied in AD patients who still live at home. The uniqueness of this study lies in the fact that the partner applied the TENS treatment (30 minutes a day, 7 days a week, during six weeks). Seventeen AD patients met the NINCDS-ADRDA criteria for the clinical diagnosis of probable AD. Nine participants received TENS treatment (experimental group) and eight participants were treated with sham stimulation (control group). Actigraphy was used to assess the circadian rhythm. After treatment, the experimental group showed a significant strengthening of the relation between the rest-activity rhythm and stable anchor points (Zeitgebers) within the 24 hours of the day compared to the placebo group ( $F(15,1) = 9.2, p = .004$ ). Moreover rest-activity rhythm was less fragmented after treatment ( $F(15,1) = 3.1, p = .05$ ) and there was a near significant increase in the amplitude of the rhythm ( $F(15,1) = 2.5, p = .07$ ). The latter implicates more activity

during the day and/or less activity during the night. Normalisation of the circadian rest-activity rhythm induced by TENS may postpone institutionalisation, improve quality of life and relief burden for the caregiver.

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**Symposium 13/5:00–6:30 p.m.**

**THE COGNITIVE NEUROSCIENCE OF NUMBER PROCESSING**

**Organizer: Hans-Christoph Nuerk**  
**Discussant: K. Willmes**

**H.-C. NUERK & A. LOCHY. The Cognitive Neuroscience of Number Processing.**

Number processing has been systematically investigated in the cognitive neurosciences only for about 20 years. Over this period of time, it has become increasingly clear that number representations are not a simple extension of language or memory representations, but rely on distinct and unique number processing capacities. The present symposium is concerned with the nature of and the transcoding between these representations in different populations. The symposium starts with a review of current semantic and asemantic models of number processing and recent findings related to those models (Seron). The next presentation will deal with one specific and important everyday task: The transcoding from verbal number words into Arabic numbers: In this translational study with children, Lochy measures the kinematics of handwriting and shows that specific language attributes lead to specific errors and strategies in the transcoding process. Barouillet uses these and other developmental data as well as neuropsychological case studies to present a new model of transcoding that can account for normal, developing and impaired number transcoding processes. Using a slightly different perspective, Nuerk examined number magnitude and parity representation in the rarely studied population of deaf signers with signed numbers and other notations: While access to magnitude representation seemed to be similar in signers and non-signers, parity representation is not. Finally, Kaufmann will present fMRI-data about the development of the functional-anatomical basis of number processing. This selection of talks as discussed by Willmes provides an up-to-date insight about current issues in the rapidly developing research field of number processing.

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**X. SERON. Numbers Transcoding, With or Without Semantic?**

In our daily-life activities, when we use numerals, we regularly pass from one code to another one (i.e.; we read aloud Arabic numerals, or we write down Arabic numerals from dictation). In this presentation we will address the question of the processes implied in these many inter-code number transcoding activities (from the Arabic code to the verbal code or the reverse). More specifically we will review the main data collected in neuropsychology, in experimental psychology and in developmental psychology regarding the debate between semantic and asemantic transcoding models. We will systematically review the virtues and the limitations of three different dominant positions: asemantic transcoding mechanisms, semantic transcoding mechanisms and multiple route transcoding models. We will argue that in the number domain it is less easy to determine the pattern of performances that permits to discriminate between these three different models and we will argue that there exist at present no clear evidence for a double dissociation as in other transcoding tasks (such as reading or writing). We will also review some specific models which propose that, according to the requirement of the task, either a semantic or a asemantic transcoding route is involved. Finally, we will underline that

the question of the activation of some semantic intermediary representations between input and output codes is related to the nature and format of such intermediary representations.

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#### **A. LOCHY. Acquisition of Transcoding Verbal to Arabic Numbers in Children: A Cross-Linguistic Study of French Versus German.**

We investigate the influence of the verbal structure of numerals on acquisition of Arabic number writing. Children in first and second grade were dictated two-digit numbers two times in the school year. Written productions were recorded by means of a digitising tablet, allowing to study parameters related to the kinematics of handwriting. We were especially interested in assessing the difficulty raised by the verbal inversion of the decade-unit structure in German compared to French (e.g., "fünfundvierzig", five-and-forty, for 45). This verbal inversion necessitates either an inverse production order strategy, i.e., to write from right to left, or to hold the verbal form in short-term memory before writing can start. Errors and kinematics were analysed and results show first, that German-speaking children commit more errors than French-speaking ones in the first grade but not any more in second grade. Second, error types vary between the two languages: in French, most errors are lexical, while in German, they consist mainly in inversions (e.g., "54") and generate inverse production order strategies. Kinematics show that inversion errors are produced slower than correct forms, while on the contrary, inverse production order strategy leads to faster writing than correct forms. This could suggest that this strategy is efficient because it allows to empty short term memory with writing. On the other hand, writing the correct form from left to right (as teachers require it) may raise interference because of writing the digital form of an element that does not correspond to what is heard/rehearsed.

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#### **P. BAROUILLET & V. CAMOS. Developmental Asemantic Procedural and Transcoding Model: From Verbal to Arabic Numerals.**

We present a new model of transcoding numbers from their verbal to Arabic form. This model called ADAPT is procedural and asemantic. Our main proposal is that the transcoding process shifts from an algorithmic strategy to direct retrieval from memory of digital forms. Thus, the model is evolutive and adaptative, and particularly suited to account for learning and development. ADAPT accounts for existing and new developmental data, for new data in learning disabled children and for the neuropsychological cases described in the literature that we review here briefly. Furthermore, ADAPT has been implemented in a computer program that simulates successfully the transcoding performances of these three populations.

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#### **H.-C. NUERK, W. IVERSEN, & K. WILLMES. On the Semantic Number Representation of Magnitude and Parity in Deaf Signers.**

The influence of the visual-iconic properties of sign language on cognitive processes has rarely been examined. In particular, the German number signs for 1–10 directly correspond to the magnitude of the associated number. However, they basically rely on a base-5 system as 6–10 are signed by a full hand (5) plus additional fingers. As signers are also familiar with written notations such as Arabic numbers or visual number words, the investigation of semantic number attributes in this population allows for both: A better understanding of the cognitive processes involved in number processing for signers, but also of how different input properties influence number processing in general. Therefore, we investigated the representation of parity and magnitude in a parity judgement (odd-even) task in different notations (number signs, visual Arabic numbers, visual number words, dice dot patterns) by examining two effects observed in non-signers: The SNARC effect (larger/smaller numbers faster

responded to with the right/left hand) and the MARC effect (even/odd numbers faster with the right/left hand). We observed SNARC effects for visual Arabic numbers, visual number words and number signs, but not for dice dot patterns. However, there was a tendency towards reverse MARC-effects (even numbers faster with the left hand). However, for signed numbers and for number words, these reverse effects seemed to be modulated by the base-5 system. Thus, magnitude seemed to be similarly activated as for non-signers while the representation of parity seemed to differ profoundly between signers and non-signers. The implication of these findings will be discussed.

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#### **L. KAUFMANN, A. LOCHY, E. WEISS, F. KOPPELSTÄTTER, C. SIEDENTOPF, E. HABERLANDT, S. FELBER, & M. DELAZER. Evidence for Age-Dependent Differential Patterns of Cerebral Activation in a Number Stroop Paradigm: A fMRI Study.**

The aim of this study was to identify the cerebral circuits involved in number comparison in children and adults. There is converging evidence that number comparison and number processing in general—is mediated by fronto-parietal cerebral networks (e.g., Chochon et al., 1999; Pesenti et al., 2000). The number Stroop is a number comparison task consisting of a physical and a numerical condition, each of which is comprised of neutral, congruent and incongruent stimuli pairs. Incongruent stimuli provoke interference/inhibition (requiring good working memory and hence frontal brain areas). The number Stroop enables us (a) to explore automatic activation of magnitude representations (which is actually irrelevant but almost irrepressible—in the physical condition that does not require to process magnitudes explicitly) and (b) to explore differential effects of working memory load on the hemodynamic response by comparing incongruent, congruent and neutral stimuli pairs. Results reveal age-dependent modulations of cerebral activation patterns. Specifically, we observed differential patterns of parietal and frontal involvement, depending on age (younger/older children/adults), task (physical/numerical) and stimuli type (congruent/incongruent/neutral). The implication of these results for current models about the anatomo-functional development of number representations will be discussed.

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**Symposium 14/5:00–6:30 p.m.**

#### **VASCULAR DEMENTIA: ASSESSMENT, IMAGING, AND TREATMENT**

**Chair: Neil Pliskin**  
**Organizer: Moises Gavia**

#### **N. PLISKIN. Vascular Dementia: Assessment, Imaging, and Treatment.**

Vascular dementia (VAD) is currently considered to be the second most common cause of dementia in Europe and in the United States behind dementia of the Alzheimer's type (DAT). However in Asia and many developing countries the incidence of VAD exceeds that of DAT. This symposium will review the consensus regarding diagnostic algorithms for dementia, the evaluation of these patients, the current data obtained from neuropsychology, and relevant new developments in the area of brain imaging. The emphasis of the symposium is not to debate the unknown aspects of vascular dementia. Rather, the intent is to help the practicing clinician effectively assess and treat patients suffering from this condition. Importance will be placed on accurately differentiating the spectrum of vascular dementia from other cognitive disorders, effective use of neuropsychological testing and neuroimaging, strategies for pharmacological



and psychosocial interventions, and approaches to prevent further cognitive deterioration in these patients.

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#### **J. KRASUSKI. Critical Points in Dementia: Recognition, Diagnosis, and Management.**

This lecture is designed to educate the neuropsychologist on the critical issues in recognizing, diagnosing, and managing the psychiatric symptoms of a patient with suspected dementia. Critical Point One is on early recognition of patient and caretaker complaints and patient's behaviors suggestive of dementia. Critical Point Two is on the diagnosis of the dementia syndrome and etiologic evaluation making appropriate use of neurocognitive testing, physical examination, laboratory and neuroimaging tests. Critical Point Three is on understanding the range of dementia etiologies with a special emphasis on Vascular Dementia. Critical Point Four is on recognizing and managing psychological symptoms and problem behaviors. Critical Point Five is on implementing family interventions to limit caretaker burnout and the patient's risk of injury in the home. Critical Point Six is on the clinician's role in family guidance on legal and financial issues related to eldercare and on appropriate referral to a family-law attorney.

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#### **C. DUROS. Neuroimaging in the Diagnosis of Vascular Dementia.**

Vascular Dementia is the second most common cause of dementia in Europe and the United States. A significant challenge in the clinical diagnosis of vascular dementia, both to improve patient care and to aid in the design of effective research protocols, is clear differentiation from other types of dementia. Neuroimaging is fast becoming a major factor in meeting this challenge. Specific recommendations for the use of MRI and CT imaging in the diagnosis of Vascular Dementia are included in the NINDS-Airen criteria, a system widely used today in clinical protocol design to ensure a homogenous study sample. However, it has been suggested that study samples may have more variability than expected. With the advent of more sophisticated imaging methods such as diffusion tensor MRI, perfusion MRI, single photon emission computed tomography (SPECT), and positron emission tomography (PET) we can better characterize the structural and functional status of the brain, and perhaps define subgroups of patient what will best respond to treatment. This presentation will highlight the currently employed imaging strategies in the clinical diagnosis of vascular dementia, and discuss new imaging modalities that may impact research protocol design and eventually improve patient care and prognosis.

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#### **G.T. STEBBINS. Diffusion Tensor Imaging in Vascular Dementia and Vascular Cognitive Impairment.**

Vascular dementia (VAD) is the second most common type of dementia. Vascular cognitive impairment (VCn) manifests as documented cognitive impairment insufficient to warrant the diagnosis of dementia. Cerebral white matter integrity has been postulated as a major determinant of cognitive impairment in vascular cases. Standard MRI techniques such as T2, proton density, fluid attenuated inversion recovery (FLAIR), and diffusion weighted (DW) imaging, provide information on the macrostructural integrity of cerebral white matter. Recent advances in MR technology allow for the assessment of microstructural integrity of cerebral white matter. Diffusion Tensor Imaging (DTI) measures the three dimensional diffusion of hydrogen on the order of microns. In white matter, intact myelin constrains the diffusion of water along the length of the axon resulting in increased anisotropy while degraded myelin allows greater diffusion perpendicular to the axon resulting in decreased anisotropy. The uses of DTI in VAD and VCI will be discussed, including basic physics of

DTI, analysis and display of results. Specific information on DTI parameters in differential diagnosis, progression of impairment, treatment effects, and correlation with cognitive functions will be presented.

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#### **N. PLISKIN. The Neuropsychological Changes in Cerebrovascular Disease.**

The effects of cerebrovascular disease on neuropsychological functioning are well recognized. There are multiple mechanisms by which vascular disease can cause dementia, including through a single strategic infarct, multiple cortical or subcortical lesions, or some combination of these. Additionally, dementia associated with vascular disease frequently resembles Alzheimer's disease in its clinical course and, in many cases, is not obviously explained by a multiple infarction mechanism. One possibility is that vascular processes cause a gradually progressive dementia syndrome. In this presentation, the core neuropsychological features associated with various forms of cerebrovascular disease will be reviewed. The differential diagnosis of vascular dementia in relation to other common forms of dementia will be emphasized, and common cognitive testing procedures that can be utilized at the bedside will be presented.

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#### **M. GAVIRIA. The Comprehensive Treatment of Vascular Dementia.**

Unlike the progressive decline of cognitive abilities in Alzheimer's Disease, the dementia that results from vascular disease presents not only with cognitive deficits but also with behavioral changes which frequently complicate treatment, and bring the patient to the attention of neuropsychiatry, neuropsychology, or neurology. Many of these patients display behavior such as apathy, pathological crying and laughing, delusions, hallucinations, and aggressive disinhibition. While the pharmacological treatment of vascular dementia lags behind that for Alzheimer's Disease, recent pharmacological trials support the principle that cholinesterase inhibitors may also show therapeutic benefit. Furthermore, the disease process may be arrested and at least partially reversed. The prognosis of cognitive decline and psychiatric symptoms improve when the cerebral perfusion is enhanced by control of hypertension, cessation of cigarette smoking, and the use of antiplatelet agents. This presentation will review the role of the neuropsychologist and neuropsychiatrist in the treatment and rehabilitation of patients with vascular dementia.

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### **Paper Session 15/5:00–6:30 p.m.**

#### **EXECUTIVE FUNCTION II**

#### **K.I. BOLLA, D.A. ELDTRETH, E.D. LONDON, M. MOURATIDIS, & M. ERNST. Decision Making and Prefrontal Lobe Function in Cocaine Abusers.**

Cocaine abusers demonstrate faulty decision-making as seen in their inability to discontinue self-destructive drug-seeking behaviors. The orbitofrontal cortex (OFC) plays an important role in this function. We tested whether 25-day abstinent cocaine abusers show alterations in cerebral blood flow (rCBF) in the OFC using PET with O-15 during the Gambling Task (a decision-making task). This task measures the ability to weigh short-term rewards against long-term losses. Cocaine abusers ( $N = 13$ ) showed greater activation during performance of the Gambling Task in the right OFC and less activation in the dorsolateral prefrontal cortex (DLPFC)—bilaterally compared to a control group ( $N = 13$ ). Better Gambling Task performance was associated with higher signal intensity in the

right OFC in both groups. Also, the amount of cocaine used (grams/week) prior to the 25 days of enforced abstinence was negatively correlated with signal intensity in the OFC bilaterally. Greater activation in the OFC in cocaine abusers provides initial evidence that OFC functioning may be less efficient in cocaine abusers. To compensate for this, they may over-activate the OFC in an attempt to meet the demands of the task. These findings also suggest that cocaine abusers show persistent functional abnormalities in prefrontal neural networks involved in decision-making and these effects are related to the amount of cocaine abused. Compromised decision-making could contribute to the development of addiction and undermine attempts at abstinence.

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**M. BRAND, E. FUJIWARA, S. BORSUTZKY, E. KALBE, J. KESSLER, & H.J. MARKOWITSCH. Risk-Taking Behavior in Korsakoff Patients.**

**Introduction:** Various studies revealed a higher risk-taking-behavior in neurological patients (e.g., with frontal lobe lesions) and psychiatric patients (e.g., schizophrenics). But so far, neuropsychological examinations of cognitive functions which may influence risk-taking-behavior are rare. In this study we examined possible neuropsychological basics of risk-taking in alcoholic Korsakoff patients (KS) with a new, self-developed test: the Game of Dice-Task (GDT). **Subjects and Methods:** 38 patients with KS (mean age = 57.6, SD = 6.6 yrs.) and 32 healthy controls (CG, mean age = 55.0, SD = 5.5 yrs.) were assessed with the GDT and further tests examining risk-perception and the disposition to risk-taking-behavior, as well as with a neuropsychological test battery. In the computerized GDT a single dice and a shaker are used. Before each throw, the subjects have to choose a single number or a combination of numbers (2, 3, or 4 numbers together). Each choice is related to specific fictive high or low gains and losses regarding their probability of occurrence. The subjects are asked to maximize their starting capital (1.000 Euro) within 18 dice tosses. **Results:** In the GDT the KS patients selected more frequently the risky choices compared to the controls (KS: mean = 11.1, SD = 5.6; CG: mean = 5.2, SD = 4.9;  $p < .001$ ). In the KS group the quantity of risky choices was correlated with the ability of risk-perception ( $r = -.41$ ,  $p < .05$ ) and executive functions (e.g., interference susceptibility:  $r = .32$ ,  $p < .05$ ). **Conclusion:** In KS patients, higher risk-taking-behavior can be observed which is influenced by cognitive disturbances such as deficient risk-perception and executive dysfunctions, more than by a general disposition to risk-taking behavior (in the sense of a personality trait).

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**H. EMSLIE, C. WILSON, V. BURDEN, & B. WILSON. Developmental Changes in Performance of 8–16 Year-Olds on a New Test of Executive Function.**

Accurate and reliable identification of deficits in executive functioning (DES) in children has been limited due to the lack of developmentally appropriate assessment tools (Anderson et al., 1998, 2001). Traditional psychometric tests are insensitive to DES and of the few tests that do measure executive functioning some were developed for use with adults and are of limited interest to children, some lack standardised administration and scoring procedures, many lack developmental norms, and often test performance does not reflect the difficulties children have in the real world outside the test situation. We have developed a new version of the Behavioural Assessment of the Dysexecutive Syndrome (BADS) test which captures a number of aspects of DES using tasks analogous to those in everyday life involving executive functioning: cognitive flexibility and perseveration, novel problem solving, impulsivity, planning and using feedback. This presentation focuses on the standardisation study involving some 262 children and adolescents between the ages of 8 years 0 months and 15 years 11 months, the developmental changes in scores and strategies captured by each of the subtests, and the relationship between test

scores and estimated IQ. We will show that the Children's BADS is ecologically valid, reliable, has child friendly administration, a standard scoring system and comprehensive norms.

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**A.E. GOUDRIAAN, J. OOSTERLAAN, E. DE BEURS, & W. VAN DEN BRINK. Pathological Gambling: Executive Functions, Sensitivity for Reward, and the Influence of Personality.**

This research aimed to contrast two theoretical models as an explanation of deficient self-regulation in pathological gambling (PG): 1) deficits in executive functions (EFs) 2) an abnormal reward and/or punishment sensitivity. Furthermore this study investigated whether this deficit is specific for PG, or whether another impulse control disorder group (Gilles de la Tourette; GTS) and addiction group (alcohol dependence; AD) display the same deficits. Effects of personality traits such as impulsivity and sensation seeking on performance will be discussed as well (Zuckerman's Sensation Seeking Scales; Zuckerman, 1987, Barratt's Impulsiveness Scale; Barratt, 1985). The AD, PG, and GTS group consisted of clinical samples. A rigorous selection procedure involved multiple standardized questionnaires and structured interviews. All participants were screened for comorbid disorders (such as other substance abuse disorders, ADHD, OCD). The first hypothesis was investigated by use of validated experimental tests of a variety of EFs, including tasks to control for differences in non EF demands. The second hypothesis was tested by systematic variation of contingencies in tests (reward, punishment and reward/punishment tasks; Go/No Go task, adapted from Newman, 1985) and inclusion of ecological valid tasks (e.g., Bechara's Gambling Task; Bechara et al., 1994). Four groups of subjects participated: a group of subjects diagnosed with PG, GTS, AD and a group of healthy controls (NC). This abstract is based on preliminary results of 25 participants in each group. The study will be extended with more subjects. Preliminary data analyses using the PG, AD and NC groups indicate an inhibition deficit in PG when reward is present. This abnormal sensitivity for reward is not restricted to tasks with a gambling component, but also present on neutral tasks which involve reward. Basic inhibitory functions (Stop Signal Task; Logan, 1994) seem to be intact.

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**K.W. LANGE, O. TUCHA, G.L. ALDERS, G. BECKER, & M. NAUMANN. Differentiation of Parkinsonian Syndromes According to Differences in Executive Functions.**

Groups of patients with Parkinson's disease (PD), striatonigral degeneration-type multiple system atrophy (MSA) or progressive supranuclear palsy (PSP) with motor disability stages II and III according to Hoehn and Yahr, and a healthy control group were compared using neuropsychological tests of executive functions. The results indicate that all three patient groups were impaired in the tests of executive functions. In comparison with healthy subjects, the three patient groups showed impaired performance regarding verbal fluency, problem solving and verbal and figural working memory. Patients with PD differed significantly from healthy subjects in a test of verbal recency, while patients with MSA or PSP were unimpaired. The comparison of patient groups revealed no differences between PD and MSA patients. However, patients with PSP showed greater impairment in both phonemic and semantic fluency than patients with PD or MSA. Using discriminant function analysis, it was found that variables derived from four verbal fluency tasks (simple and alternate semantic and phonemic fluency) discriminated among the three patient groups at a level significantly exceeding chance. Over 90% of patients with PSP were correctly classified. Patients with PD and MSA were correctly classified in over 70% of cases. These results suggest that verbal fluency tasks may be sensitive measures in the differential diagnosis of PD, MSA and PSP.

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**J. ALLEN, L. SAMSON, & M. CECIL. Executive Function Deficits and Adaptive Functioning in Parkinson's Disease.**

The current study sought to clarify the relationship between adaptive functioning (activities of daily living) and executive control deficits in a sample of individuals with Parkinson's Disease. The current study included 55 individuals (26 with Parkinson's disease, and 29 healthy elderly controls) recruited through a support group for Parkinson's disease located in a moderately-sized city in the Midwest of the USA. The total sample included 31 women and 24 males with a mean age of 70 years. All participants in the study received a battery of neuropsychological measures that included a number of executive control tasks (Wisconsin Card Sorting Test, Stroop Color-word Test, etc.) as well as measures of adaptive functioning (Adult Functional Adaptive Behavior Scale; Community Integration Questionnaire, etc.). Along with comparing the overall level of performance of the control and Parkinson's groups on the executive control measures, correlational analysis was used to determine the relationship between executive control measures and adaptive abilities in both the control and Parkinson's groups. The color-word T-score of the Stroop ( $t = 3.36$ ;  $p < .001$ ) and the number of categories achieved from the Wisconsin Card Sorting Test ( $t = 2.20$ ;  $p < .032$ ) appeared to represent the largest group differences in performance. A number of significant relationships between executive functioning and adaptive abilities emerged for the Parkinson's group. For example, the Color-Word score from the Stroop was significantly correlated with both the AFABS ( $r = .74$ ,  $p < .001$ ) and the CIQ ( $r = .46$ ,  $p < .05$ ). Additional findings of interest will be discussed and related to issues of clinical relevance.

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**Paper Session 16/5:00–6:30 p.m.**

**AWARENESS/ANOSOGNOSIA**

**S. FISCHER, S. GAUGGEL, & L.E. TREXLER. Awareness of Activity Limitations, Goal Setting, and Rehabilitation Outcome in Patients With Brain Injuries.**

The purpose of this study was to examine the relationship between self-awareness, goal setting ability (i.e., ability to set realistic goals), and performance/outcome on a cognitive task and rehabilitation in 63 patients with brain injuries of different etiologies. Self-awareness was measured with direct clinicians' judgement (CJA) and the comparison of patient and staff ratings in the Patient Competency Rating Scale (PCRS). Results for goal setting ability demonstrated that the awareness measures predicted 32% of the variance in the rehabilitation context but only 4% of the variance in the cognitive task. Regarding performance/outcome, the awareness measures predicted 33% of the variance for rehabilitation outcome and 5% of the performance in the cognitive task. Surprisingly, only the PCRS showed the expected direction of relationship with the predicted variables (i.e., better awareness was related to more realistic goal setting and better outcome). The results for CJA were mostly contradictory to that expectation. Overall, it can be concluded that self-awareness seems to be related to goal setting ability and outcome in a long-term rehabilitation process but less in short-term experimental tasks.

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**D. HOOFIEN, A. BLOCH, & O. BARAK. An Experimental Study of Awareness of Deficits and Behavior Among Persons With TBI.**

Previous studies reported inconsistent results with regard to the association between unawareness of deficits and outcome among persons with TBI. One reason for this inconsistency may stem from weak connections between self-awareness and adaptive behavior. In order to address this question, the present study applied an experimental design to examine the degree at which self awareness of memory deficits is related to strategy-application behavior during the performance of a memory task. Twenty-

four persons with TBI who suffered severe memory problems but still maintained preserved intellectual ability, and 33 control subjects participated in the study. In the experiment, the participants performed a "paired cards" memory task, during which, upon request, a clue to the correct answer could be "purchased". Self-awareness was measured as the difference between self evaluation of memory ability and actual performance, with respect to general memory ability and to the specific memory demands of the experimental task. As expected, persons with TBI performed lower than controls on the memory task, yet mildly over-estimated their memory abilities. These participants tended to report relatively diminished memory ability, but still they failed to evaluate the actual extent of their deficit. In addition, degrees of self awareness, general as well as task-specific, were unrelated to strategy application in the form of help seeking, i.e., demanding clues for the correct solution. The findings are interpreted in terms of the dissociation between awareness and the functional implications of the disability and its application to behavior.

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**C. LOUREIRO, T. FERNANDES, B. DIAS, R. DA SILVA, & I. PAVÃO MARTINS. Demonstrating the Evidence: Phonological Awareness and Digit Span in Children.**

**Background:** Phonology is a factor of major importance in reading acquisition. As demonstrated by Morais and colleagues, phonemic awareness does not emerge naturally from other kinds of phonological awareness. It arises from acquisition of the alphabetic code. A phonological deficit is revealed by low scores on phonological awareness tasks and impairment on working memory tasks, like digit span. **Objectives:** to delineate the performance pattern on phonological tasks in Portuguese children and to analyse correlations between different tasks of phonological awareness and digit span. **Methods:** 171 children 6.5–12.5 years old, from public and private schools, between 1st–6th grades were included. Tasks applied were digit span (WISC), and phonological tasks including omission of the first syllable and phoneme, manipulation of the first syllable and a rhyme judgment test. **Results:** We've found no sex or school differences. Educational level and age had a significant effect on all tasks, although only the former has a main effect on the results. Digit span was a good predictor of the performance on the omission of the first phoneme task and the rhyme judgment test. There was a significant correlation between syllable tasks, and between the syllable manipulation test and rhyme judgement. **Discussion:** Our results are similar to those found in previous studies, demonstrating a correlation between phonemic tasks and digit span. In Portuguese children the most important factors on phonological awareness tasks are educational level and automaticity of the reading processes.

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**S.V. MÜLLER, J. MÖLLER, A. RODRIGUEZ-FORNELLS, & T.F. MÜNTE. Brain Potentials Related to Internal and External Information Used for Performance Monitoring.**

A central characteristic of humans is that they have to be able to operate under circumstances where less than optimal information is available. How, then, are actions monitored, if their quality and adequacy is in doubt? This was investigated with a feedback task while recording event-related potentials (ERPs). In a study-phase, subjects had to learn picture-button-associations for 12 different pictures. In the subsequent test-phase, pictures were presented several times in random order and had to be responded to by the appropriate button. One second after the onset of a picture feedback was provided. In most cases, a veridical feedback (negative or affirmative as appropriate) was delivered, in 20% of the trial (equivocal) feedback was presented, leaving the subject in doubt whether or not the response had been adequate. Time-locked to the erroneous responses, an error-related negativity was obtained, which showed a typical frontocentral distribution and can be taken as an index of the internal self-



monitoring system of the subjects. With regard to external information on the quality of the subject's performance, ERPs to negative and equivocal feedback were both associated with a phasic negative component relative to ERPs to positive feedback. The amplitude of the feedback-related negativity was increased by a factor of 3 in the equivocal relative to the negative feedback condition, while the morphology and distribution of the effect in the two conditions was virtually identical. Interestingly, the distribution of the feedback-related negativity was clearly different from the error-related negativity suggesting the involvement of different brain systems in the processing of internal and external information on performance quality.

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#### **J.A. OGDEN & A.M. MAGUIRE. Anosognosia, Persisting Neglect, and Recovery From Hemiplegia.**

Previous studies of anosognosia and unilateral neglect (UN) have found that (i) anosognosia and persisting UN do not necessarily co-occur, (ii) anosognosia is usually only apparent in the first few days post-CVA and is a predictor of LFN severity, (iii) extrapersonal neglect plus anosognosia

for motor deficits at one month predicts a poor recovery from hemiplegia, (iv) anosognosia is associated with a lesion of the infero-posterior-parietal lobe or thalamus. Over 18 months in two stroke rehabilitation units serving a population of 1 million, we identified only 13 adults (16–65 yrs) with UN persisting >3 months. All demonstrated LFN on the Behavioural Inattention Test 4–6 weeks post-CVA. Three to 22 months post-CVA, 9 of the 13 were given a comprehensive neuropsychological assessment. UN and extinction in all modalities, different subtypes of anosognosia (for a motor deficit, personal neglect, and visual field neglect), hemiplegia and somatosensory deficits were also objectively assessed. MRI brain scans were performed and analysed in detail to ascertain all anatomical areas damaged by the CVA. Our results demonstrated that 3 to 22 months post-CVA (i) all participants demonstrated UN, personal neglect, and two or three types of anosognosia, (ii) more severe anosognosia was correlated with more severe UN, (iii) anosognosia subtypes could be dissociated, (iv) anosognosia was not correlated with recovery from hemiplegia, and (v) all participants had large lesions including 3 or more cortical or sub-cortical areas, as well as, in all cases, the basal ganglia. Two participants had lesions not involving the parietal lobe.

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### **Saturday Morning, July 19, 2003**

#### **Poster Session 5/9:00 a.m.-12:30 p.m.**

##### **EXECUTIVE FUNCTION**

#### **B. BROKATE, E. HOFFMANN, & H. HILDEBRANDT. Response Inhibition and Decision-Making of Alcohol Dependent Patients Without Amnesic Syndrome.**

Most of the research on alcohol toxic effects on the brain revealed neuronal degeneration, hypoperfusion and functional changes of the prefrontal cortex in alcoholics without amnesic syndrome but with a long term history of alcohol consumption. Recently, our results of two studies suggested a non impaired dorsolateral prefrontal cortex, because of the good performance on working memory tasks irrespective of increasing interference. We concluded that the ventromedial prefrontal cortex was sensitive to alcohol toxic effects and yielded deficits in response inhibition, object alternation and set shifting. Moreover the alcoholics were not sure in retaining internal cues, when complex mental demands were required. Likewise, this could be seen in the context of reward learning. Bechara et al. (2001, 2002a, 2002b) pointed out the deficits on reward learning, corresponding with dysfunctions of the ventromedial prefrontal cortex on alcoholics. We investigated a group of alcoholics on the gambling task, the alternate response task of the test battery of attentional assessment (TAP) and the "incompatibility" (TAP), a task with spatial interference solution on focused attention. Furthermore we included the intradimensional/extradimensional shift task of the CANTAB. The results yielded a clear and replicated impairment on the alternate response task and only a slight impairment on the shift task of the CANTAB. On the gambling task the alcoholics tended to take risks. They obtained fast rewards with long-term losses and showed no reaction after punishment. The results were discussed in relation to Bechara et al.'s findings.

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#### **L. ALBUQUERQUE, C. LOUREIRO, M. COELHO, I. PAVÃO MARTINS, & J. IRBY. Category Fluency in Patients With Well-Defined Frontal and Temporal Lobe Lesions.**

Studies examining the laterality and underlying neural mechanisms of category fluency have been mixed. Activation studies suggest that the

semantic retrieval process is mediated by left temporal lobe structures (Pihlajamäki et al., 2000). However, lesion studies suggest that category fluency may also be mediated by both left and right frontal lobe structures (Baldo & Shimamura, 1998). The purpose of the present study is to present category fluency data collected from an ongoing series of neurologic patients with well-defined focal lesions. Specifically, we compared age and education adjusted category fluency scores in patients with well-defined left ( $n = 4$ ) and right ( $n = 5$ ) frontal lobe lesions to patients with well-defined left ( $n = 8$ ) and right ( $n = 3$ ) temporal lobe lesions. Patients with right hemispheric lesions performed significantly worse on category fluency tasks than patients with left hemispheric lesions. No significant differences were found on category fluency tasks between patients with frontal or temporal lobe lesions, and no significant interaction was noted. The results suggest that the right hemisphere plays an important role in semantic fluency. The results are discussed in terms of the right hemisphere's putative role in shifting attention and switching strategies. The limitations of the study are addressed, and suggestions and plans for future research are discussed.

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#### **M. ARIZA, C. JUNQUÉ, M. MATARÓ, M.A. POCA, N. BARGALLÓ, M. OLONDO, & J. SAHUQUILLO. Basal Ganglia Neurochemical Dysfunction According to Proton Magnetic Resonance Spectroscopy and its Relationship With Frontal Impairment in Traumatic Brain Injury.**

Proton magnetic resonance spectroscopy 1H-MRS allows an in vivo determination of neurochemical regional status. Our aim was to investigate whether a decreased level of proton NAA in the basal ganglia is related to frontal dysfunction in TBI. Twenty patients with moderate and severe traumatic brain injury (GCS: 3–12; mean = 7; SD = 2) and twenty matched controls were studied between 6 and 12 months after injury. The neuropsychological test battery was designed to probe frontal functions commonly impaired after TBI. The NAA/Cho ratio was significantly lower ( $p = .002$ ) in TBI than in control subjects. The performance in frontal functions was significantly poorer in patients with TBI than in control subjects in almost all functions assessed. NAA/Cho ratio correlated with

several measures of fine motor speed and attention: digits backward ( $p = .04$ ), digits forward ( $p = .003$ ), reaction time ( $p = .03$ ), Trail Making Test Part A (TMT A) ( $p = .007$ ) and digit symbol ( $p = .03$ ). In control subjects, the relationship between neurochemical levels and neuropsychological performance was not significant. Our results showed a strong relationship between decreased levels of NAA in the basal ganglia and frontal dysfunction. The results indicate neuronal loss in the basal ganglia after TBI, probably due to secondary ischaemic damage and suggest the involvement of the basal ganglia in the frontal symptomatology of TBI.

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### **C. BÄUMER. Perceiving Time: What's the Prefrontal Cortex Got to Do With it?**

Several studies (Hicks, 1992; Macar & Casini, 1998) emphasized the important role of the prefrontal cortex during time estimation. Due to these findings two theories of time estimation, the attentional model (Thomas & Weaver, 1975) and the contextual change model (Block, 1985, 1989), were evaluated in patients with damage in the prefrontal cortex concerning primarily the prospective paradigm. Using  $N = 20$  prefrontal and  $N = 20$  normal subjects, three time intervals (30, 90, and 180 seconds) were estimated using the method of verbal estimation and the method of reproduction within a repeated measurement design. Patients with a prefrontal lesion had longer time estimations in short time intervals than normal subjects. There was no difference between groups in estimating longer time intervals. This seems to be related to an impairment of short term memory after a damage in the prefrontal cortex, although neither the attentional model nor the contextual change model can explain the greater overestimation of the prefrontal group in the 30-seconds time interval. Because prefrontal and normal subjects different ratings of task difficulty in this experiment, both groups cannot be easily compared. Subjects with a prefrontal lesion perceived time duration shorter the higher the cognitive effort. These findings support the attentional model which predicts that magnitude of duration judgements reflect the amount of attentional resources available for temporal information processing.

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### **A. BECHARA & E.M. MARTIN. Decision-Making and Drug of Choice in Substance Dependent Individuals—A Preliminary Report.**

Current studies implicate dysfunction of orbitofrontal cortex in the genesis of addiction. Many but not all substance dependent individuals (SDI) perform abnormally on a task failed by persons with ventromedial/orbitofrontal lesions; a simulated gambling task designed to capture impaired decision-making. We tested a group of SDI using the Gambling Task (GT) and investigated whether different substance abuse variables might be associated with increased risk of decision-making deficits. We tested 41 detoxified SDI with SCID SAM-verified diagnoses. Subjects' reported drugs of choice included alcohol ( $n = 17$ ), cocaine ( $n = 8$ ), and methamphetamine ( $n = 16$ ). All subjects completed a computerized version of the Iowa Gambling Task as part of a larger investigation of cognition in drug abuse. We classified each subject's performance as normal or abnormal using previously published criteria. Individuals with normal *versus* abnormal GT performance did not differ significantly in mean years of substance abuse or number of days since last use. However, 88% of the subjects who identified methamphetamine as their drug of choice performed the GT abnormally, compared with 47% and 31% of subjects reporting alcohol or cocaine, respectively ( $p < .02$ ). These three groups did not differ significantly in demographic or substance abuse characteristics. Significance of this preliminary finding that individuals with differing drugs of choice performed differently on a probe task of ventromedial/orbitofrontal integrity remains to be determined. However, this preliminary finding suggests that subjects' reported drug of choice at testing might

provide useful information when determining risk factors for cognitive deficits even though the majority of SDI misuse multiple substances.

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### **G. JOPPICH, J. DÄUPER, S. JOHANNES, R. DENGLER, & T.F. MÜNTE. Changes in Executive Functions in Parkinson Patients as Indexed by Brain Potentials During Random Number Generation.**

In addition to motor symptoms, impairments in psychological functions, in particular executive processes, are well documented in Parkinson's disease (PD). In cognitive psychology one accepted paradigm to assess executive control functions is the random number generation (RNG) task, which requires the generation of a random sequence of digits. In this study reaction times and event-related brain potentials (ERPs) of 12 PD patients and 12 age-matched controls were obtained in a modified RNG and an ordered number generation (ONG) task in different runs with the right and left hand. The present experiment employed the dual task methodology: The primary task was to produce numbers by pressing keys on a keyboard under ONG or RNG instructions in response to frequent standard tones. The secondary task was to respond by a specified key-press whenever a rare target tone occurred. Additional measures of executive functions were obtained using classical neuropsychological tests. Changes in executive control, as evidenced by differences in "randomness" between the PD and control group can be interpreted in light of the ERP results. These indicate problems with resource allocation in PD.

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### **G. JOPPICH, J. DÄUPER, S. JOHANNES, R. DENGLER, & T.F. MÜNTE. Brain Potentials Index Executive Functions During Random Number Generation.**

A major division of metacognitive functions can be made between strategic aspects of cognitive control and evaluative processes or performance monitoring functions. In cognitive psychology, one accepted measurement for executive functions focusing aspects of cognitive control is the random number generation (RNG) task, which requires the generation of a random sequence of digits. In this study reaction times and event-related brain potentials (ERPs) of 16 healthy volunteers were obtained in a modified RNG and an ordered number generation (ONG) task in two different speeds on separate runs, with the right and left hand. The present experiment employed the dual task methodology: The primary task was to produce numbers by pressing keys on a keyboard in either an ordered sequence (ONG) or in a random sequence (RNG) in response to frequent standard tones. The secondary task was to respond by a specified key-press whenever a rare target tone occurred. Behavioural data revealed typical, speed-dependent patterns with superior randomness in the slow speed. ERPs index changes in mental resources devoted to executive control and show aspects of conflict monitoring as revealed by a significant difference between ONG and RNG in small negative component corresponding to the Error related Negativity "ERN or Ne" for the correct responses as a measure of conflict monitoring.

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### **S. KARCH, T. GOSCHKE, D.Y. von CRAMON, & O. GRUBER. Neuronal Mechanisms of Persisting Inhibition of Distracting Perceptual Dimensions in Task-Switching.**

Adaptive human behavior requires a context-sensitive balance between flexible adjustments of cognitive sets in response to changing task demands and stable maintenance of cognitive sets in the face of distraction. We assume that control processes that promote maintenance of a current intention by suppressing distracting information are specifically triggered by the presence of response conflicts. In a task-switching paradigm one

should thus expect increased switch costs on trials preceded by response-incongruent stimuli due to persisting inhibition of distracting stimulus dimensions. An fMRI study was conducted to assess the neural correlates of "conflict-triggered inhibition". Twelve healthy volunteers performed a task-switching paradigm, in which abstract objects had to be classified according to either color or shape. Increased switch-costs after response-incongruent trials only occurred when participants switched from the color to the shape task, but not when they switched from the shape to the color task. Given that in our paradigm most of the stimuli had a neutral color (white), the sudden occurrence of stimuli in a different color presumably elicited a mismatch effect, which was superimposed on the persisting inhibition effect. This mismatch was associated with activations along the inferior frontal sulcus and in parieto-occipito-temporal association areas. In contrast to previous studies of neural mechanisms of conflict detection we did not find significant activity changes within the anterior cingulate cortex related to response-incongruency. Further analyses will determine the functional connectivity between the activated brain regions in order to assess the dynamic interactions of bottom-up and top-down processes involved in this task-switching paradigm.

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**E.M. MARTIN & A. BECHARA. Drug of Choice and Working Memory Performance in Substance Dependent Individuals—A Preliminary Report.**

**Background:** Working memory (WM) deficits are commonly but not inevitably present in substance dependent individuals (SDI) and one question concerns which variables are critical to risk of impaired WM. We studied WM performance in a group of detoxified SDI and investigated whether working memory performance varied according to substance abuse characteristics. **Methods:** Subjects consisted of 41 detoxified substance dependent individuals with diagnoses verified by the SCID-Substance Abuse Module. Subjects' reported drugs of choice included alcohol ( $n = 17$ ), cocaine ( $n = 8$ ), and methamphetamine ( $n = 16$ ). All subjects completed a computerized delayed non-match to sample task that required the subject to maintain information on line for varying delay intervals prior to making a response, as part of a larger investigation of executive function in drug abusers. **Results:** Subjects who identified methamphetamine as their drug of choice performed the task significantly more poorly compared to subjects who preferred alcohol ( $p < .02$ ), although cocaine users' performance did not differ significantly from either of these groups. Groups did not differ significantly in mean age, education, estimated verbal intelligence, time since last use, number of years of substance use, psychological distress or additional comorbid conditions. **Conclusions:** Substance dependent individuals grouped according to their self-reported drug of choice showed significant group differences in working memory performance. The significance of this finding is not clear at present and data await replication. The majority of substance dependent individuals misuse multiple substances, but this intriguing preliminary finding suggests that subjects' reported drug of choice at testing might provide useful information when determining risk factors for cognitive deficits.

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**J.M. MUÑOZ-CESPEDES, M. RIOS, N. PAUL, F. MAESTU, J. ALVAREZ-LINERA, A. FERNANDEZ, & T. ORTIZ. Attention and Executive Control Processes: A MEG, fMRI, and Neuropsychological Study.**

Several studies have measured the neurophysiological basis of attention and executive control. However, these processes have not been studied in the same group of subjects using three different perspectives: cerebral blood oxygenation, magnetic activity and behaviour. The major goal of the present study was to identify the neural network underlying the performance of sustained attention and executive attention tasks, and to establish temporospatial patterns of activation in normal subjects during the

execution of these specific tasks. The second purpose was to investigate the multimodality data fusion and the possible relationship among the spatial resolution of fMRI, the temporospatial dynamics using MEG and the ties between the neurophysiological data and the results obtained by neuropsychological assessment procedures. fMRI and MEG were employed to measure the hemodynamic and magnetic response during a sustained attention task (modified continuous performance test, CPT), and a response inhibition task (go-no go paradigm) in 15 healthy subjects. In addition, a complete neuropsychological assessment was performed, including attention, memory, and executive functions. Some of the scores were selected for statistical analysis. The results obtained reveal distributed brain areas constituting the network. Nevertheless, there is a high degree of overlap during the execution of the two tasks. This finding led us to identify the common regions participating in both anterior and posterior components of attentional processes. Some differences among techniques and the inter-relations between neuropsychological assessment and neurophysiological measures are discussed.

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**O. TUCHA, L. MECKLINGER, R. LAUFKÖTTER, H.E. KLEIN, & K.W. LANGE. Clustering and Switching on Verbal and Figural Fluency Functions in Adults With ADHD.**

Neuropsychological studies of adult patients with ADHD have revealed marked disturbances in executive functions including impairments of attention, working memory, impulsivity, shifting and divergent thinking. Phonemic fluency tasks, in particular, have been shown to be sensitive measures for the assessment of executive functions in adults with ADHD. The present study examined figural fluency and both phonemic and semantic verbal fluency in 34 adult patients with ADHD and 34 healthy participants. For evaluation of fluency performance, the number of words or designs, the number of repetitions and the number of deviations from test rules were calculated. Furthermore, clustering strategies and switching responses were analyzed. In comparison with healthy participants, patients with ADHD produced significantly fewer words or designs, but they did not differ from healthy participants in the number of repetitions or rule violations. Analysis of switching and clustering showed that patients produced significantly fewer switching responses on both verbal fluency tasks, although patients tended to generate smaller clusters. Switching on the figural fluency task was unimpaired. The results of the present study suggest that adult patients with ADHD may suffer from an organizational dysfunction that may affect retrieval processes, categorization of knowledge and inhibition of irrelevant cognitive processes.

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**A. VERDEJO-GARCIA, C. OROZCO, M. SEDO, & M. PEREZ-GARCIA. Impairment of Central Executive Attentional Processes in Heroin Abusers.**

The Five Digit Test (FDT; Sedo, 1998) is a neuropsychological task divided into four parts: the first and second parts are related to automatic processes of fluent reading and naming respectively. The third and fourth parts are sensitive to controlled processes of selective and divided attention. On the third part, the patient has to count instead of reading numbers printed inside boxes. On the fourth part the patient is required to count or read the numbers according to the clearness or darkness of boxes. We used this task as part of a selective executive functions assessment procedure developed to evaluate 35 Spanish polysubstance abusers. Results of multiple regression analyses showed severity of heroin consumption was significantly related to impaired performance on selective ( $F = 5.041$ ;  $p < .05$ ) and divided attention conditions ( $F = 4.180$ ;  $p < .05$ ) of the task. Severity of heroin consumption was not related to performance on the interference condition of the Stroop task, a classic experimental paradigm of controlled attention and response inhibition. Our results are specially relevant considering the relatively few reports of executive impairment in heroin



abusers (Rogers and Robbins, 2001; Verdejo et al., 2002), who tend to perform normally on many tasks of executive function. However, the development of new sensitive measures throughout the last few years is leading to conclude that the executive impairment exist indeed (Madden et al., 1997; Ornstein et al., 2000). Our study adds new evidence to the existence of this executive impairment in heroin abusers and supports the FDT as a sensitive measure in detecting selective impairments in executive attentional processes.

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**P. STENNEKEN, J. COLE, J. PAILLARD, W. PRINZ, & G. ASCHER-SLEBEN. Coordinating Movements in Time: The Role of Sensory Movement Consequences.**

The temporal coordination of movements is assumed to rely to a large extent on perceived sensory consequences. For investigating the specific role of intrinsic (somatosensory) consequences, which can only be studied indirectly, patients with somatosensory loss and spared motor function provide a strong model. We conducted a series of temporal coordination experiments; subjects were two deafferented patients (IW, GL) with complete tactile and kinaesthetic loss due to peripheral neuropathy, a group of patients with partial sensory loss due to cerebral lesions and two unimpaired control groups of different ages. Even when all feedback was removed the peripherally deafferented patients were able to coordinate repetitive finger tapping movements to a metronome rather precisely and showed a highly consistent temporal pattern comparable to that of control subjects. This reflects a preserved anticipatory timing behaviour and challenges the view of motor control by perceived sensory consequences. Results are discussed in terms of internal forward models, allowing for a prediction of sensory movement consequences. This approach, rather well established for the spatial aspects of motor control, will be proposed for the coordination of movements in the temporal domain. Additional evidence is provided by the performance of the cerebrally lesioned patients. Even though their sensory impairments were less severe compared to peripherally deafferented subjects, they showed a more variable timing pattern, suggesting that in addition to the severity of the sensory loss, the functioning of specific brain structures is an important factor in the anticipatory control of movements.

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**E. KARNER, E. LUGINGER, C. JENNER, W. EISNER, G. WENNING, & T. BENKE. Deep Brain Stimulation of the Subthalamic Nucleus: Comparison of Pre- and Postoperative Cognitive Functions and Behavior.**

Deep brain stimulation (DBS) of the subthalamic nucleus (STN) is an effective neurosurgical treatment for the motor symptoms of patients with advanced Parkinson's disease (PD) refractory to medical treatments. Most of the studies report significant motor improvements, but results regarding the cognitive outcome are variable. Common findings are improvements of mood and deterioration in verbal fluency. In an ongoing study we screened 30 patients before operation; 8 patients were followed up 6 months after bilateral DBS and 7 patients one year postsurgery to detect changes in cognitive functions and behavior. A neuropsychological battery was selected to evaluate a broad range of functional domains including global mental functions, verbal and figural memory, language, arithmetic abilities, frontal-executive functions and mood. Preoperatively, most of the patients presented with the typical cognitive pattern of advanced PD including impairments in verbal memory and executive functions, and 30% were diagnosed as having minor depression. Six months after the operation we found a significant deterioration in verbal memory and a trend towards improvement of arithmetic abilities. After 1 year there was no significant group difference between pre- and postoperative findings. Apart from neuropsychological measures most of our patients reported a gain of weight and more interest in sexuality. Some of them revealed hypophonia

and dysarthria. From these preliminary results, bilateral DBS appears to be a safe procedure regarding the cognitive status of long-term PD patients. Correspondence: Elfriede Karner, Universitätsklinik für Neurologie, Abteilung Neuropsychologie, Anichstraße 35, A-6020 Innsbruck, Austria. E-mail: elfriede.karner@uklibk.ac.at

**H.M. SMEDING, R. TEN DIJKE, J.D. SPEELMAN, & B. SCHMAND. Procedural Learning in Parkinson Patients After Bilateral Stimulation of the Subthalamic Nucleus.**

The subthalamic nucleus is one of the target structures for deep brain stimulation in patients with advanced Parkinson's disease. This structure forms part of the neural network that is involved in procedural learning. Therefore, stimulation of the subthalamic nucleus might affect procedural learning capacities. We examined cognitive and motor procedural learning in eight Parkinson's patients within three months before and two weeks after stereotactic surgery for stimulation of the subthalamic nucleus. A serial reaction time task and a computerized maze learning task were used as operationalizations of motor and cognitive procedural learning, respectively. Basic reaction speed, declarative memory, and executive functioning were also examined. The results showed that both types of procedural learning decreased after surgery, whereas basic speed increased. Thus, patients reacted faster but learned less. This decrease in procedural learning was not related to changes in memory or executive functioning.

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## NEUROPSYCHOLOGY OF LANGUAGE

**M.L. BERTHIER, J. HINOJOSA, I. MORENO, M.C. MARTÍN, & I. FERNÁNDEZ. Exploring the Continuum of Deep Dysphasia/STM-Based Repetition Disorder.**

Deep dysphasia (DD) is an exceptional and severe disorder characterised by the production of semantic paraphasias (e.g., cat → "lion") in single-word repetition, impaired nonword repetition, better performance on the repetition of high- than low-imageability words and restricted short-term memory span. Short-term memory (STM) based repetition disorder (conduction aphasia) is characterised by a less severe impairment of word span and absence of semantic paraphasias and imageability effects in single-word repetition. N. Martin (1996) suggested that DD and STM-based repetition disorder lie on a continuum of severity, yet few cases confirming this prediction have been published. We report 4 patients with chronic repetition conduction aphasia secondary to temporoparietal stroke lesions. Individual analysis of language profiles placed them in the middle of the DD and STM-based repetition disorder continuum because they showed deficits peculiar to both disorders. The 4 patients had digit- and word-spans restricted to 2 or 3 items and impaired nonword repetition. They also produced formal paraphasias in single-word repetition and demonstrated a primacy effect on three-word list repetition, performing better with familiar and meaningful semantic information, a pattern similar to prototypical cases of STM-based repetition disorder. However, the 4 patients also had features resembling DD since they produced semantic paraphasias on the repetition of three-word lists and paraphrases in sentence repetition. Our description of patients with linguistic deficits bordering DD and STM-based repetition impairment is in line with the notion that these disorders are variants of the same functional disorder affecting the storage capacity of the phonological and lexical-semantic linguistic processes.

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**S. KRUCK, S. BERTI, T. HIES, & K. ALTER. Auditory Evoked Potentials: Processing of Syllables and Level Identical Noise.**

One general aim in the wide field of speech research is to extract temporal acoustic factors which could serve as important cues for the understanding of meaningful units in speech. Yet, it is not known which of the speech-

specific acoustic cues like envelope, periodicity and fine structure are most important for the auditory stream segregation. Previous studies which investigated the perception of amplitude envelope information extracted from the speech signal showed that the temporal envelope information with reduced spectral information can help to detect the native language of the listener. However, one limiting factor in the processing of speech is the capacity of neural processing in the central auditory pathways. This processing can be taken into account if we measure directly the outcome with non-invasive methods while comparing different acoustical parameters. To measure brain activity during the auditory presentation of speech and non-speech stimuli we recorded event related potentials (ERPs). As speech stimuli we used different consonant-vowel syllables (CV). Non-speech stimuli were produced by using the envelope of the syllables to generate level identical noise. With this method, speech and noise signals are equal in time and amplitude, allowing us to observe the processing of the underlying spectral cues. In summary, we found a significant effect in the comparison of speech and level identical noise in passive and active listening. The difference wave of syllable and noise evoked potentials revealed a specific component (N 170) as shown in previous studies independently of attentional requirements.

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**J. MÜLLER, A. HAHNE, Y. FUJII, & A.D. FRIEDERICI. Event-Related-Potentials in Processing Japanese Syntax.**

ERP-studies in several European languages have been identifying ERP components sensitive to specific language related processing mechanisms. Semantic violation conditions normally lead to a centro-parietally distributed N400, whereas syntactic violations often elicit left anterior negativities (LANs, ELANs) which can be followed by more posterior late positivities (P600). Japanese is an interesting example to test the language generality of the processes reflected in these ERP components as it is not related to Indoeuropean languages. The N400 for semantic violations and the P600 for syntactic violations are reported to occur in Japanese (Nagakome et al., 2001) but no left anterior negativity has been shown yet. In an auditory ERP-experiment using a miniature Japanese language system we investigated processing of syntactic information in Japanese native speakers. ERPs of correct Japanese sentences were compared with ERPs of sentences containing specific syntactic violations. For a phrase structure violation we found an early anterior negativity followed by a P600. A violation of case marking elicited an early left negativity which was followed also by a P600. A violation of the agreement between a noun and its numeral classifier elicited only a left anterior negativity and no P600. The results show that syntactic violations in Japanese can elicit early negativities and a P600 with the former probably reflecting the automatic detection of the syntactic error and the later component a more controlled reanalysis. Processing of numeral classifier violations suggests that this aspect of language processing is rule-based.

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**M. WANNKE, A. BLENDER, & B. PREIŁOWSKI. Acoustical Modifications Do Not Improve Speech Sound Discrimination of Dyslexics.**

Merzenich, Tallal and colleagues have claimed that specific language impairments may stem from an underlying deficit in processing rapidly changing auditory stimuli. They reported that acoustical modifications of speech may increase the efficiency of computer-based language training programs. These claims also have been extended to developmental reading disorders. Although these findings have evoked an intense discussion, few attempts have been made to test the core hypothesis directly, i.e., that the said acoustical modifications improve the discrimination of speech sounds. Children with specific reading and/or spelling disorders ( $n = 36$ ) were compared to unimpaired children matched in age, gender, and school level. They performed a speech discrimination task (SDT), an auditory gap detection task, and a phoneme awareness task. In both groups the acous-

tical modifications reduced the number of correct responses in the SDT significantly. Since the reading/spelling impaired children on average showed greater difficulties in phoneme awareness and gap detection, they were expected to profit more from the suggested acoustical modifications in accordance with the hypothesized etiology. Data did not support this expectation, as the reduction of the number of correct responses in the SDT did not differ significantly from unimpaired children. These data seem to question the core hypothesis in respect to specific reading/spelling disorders. Unless our data are subject to specific properties of the German language, we suggest that further research should focus on both specifying sub-types of reading/spelling disorders and on other than speech-related, e.g., attentional, concomitants of acoustical modifications.

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**G. WOOD, H.-C. NUERK, G. FREITAS, P. FREITAS, & K. WILLMES. How Do Semi-Illiterates Read Arabic Numbers?**

The central semantic magnitude representation for numbers has been described as a holistic and logarithmically compressed mental number line (Dehaene et al., 1993). Nevertheless, there is also evidence for non-holistic processing. Reaction times are faster and more accurate in magnitude comparison of two two-digit numbers if the comparison between decade and between unit numbers leads to the same decision (compatibility-effect, Nuerk et al., 2001; e.g., 32\_47, as  $3 < 4$  and  $2 < 7$ ). In the present study was examined how non-holistic processing depends on reading ability. The alphabetic hypothesis assumes, that Arabic decade and unit numbers are read separately according to orthographic integration mechanisms. The arabic-number hypothesis predicts, that the Arabic numerical system represents numerical magnitude in a position-value-system, with weighted additive composition. We have tested the compatibility-effect in 19 Brazilian semi-illiterates (mean age = 35.3 yrs.; range: 19–52 yrs.). In a magnitude comparison task participants had to decide which of two visually presented two-digit numbers was the largest. Besides decade-distance and unit-distance, decade-unit compatibility was systematically varied. Reading performance and number knowledge were assessed using a lexical decision task and a numerical transcoding task. We found a distance-effect for decades, and also a consistent compatibility-effect, which interacted with unit-distance such that the compatibility-effect becomes larger with larger unit-distance. Our results cannot be accounted for by the alphabetic hypothesis, but by the arabic-number hypothesis. Poor readers are sensitive to the compatibility-effect just as normal readers. Therefore we conclude that the non-holistic processing of two-digit numbers is independent of reading abilities.

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**V. BALASUBRAMANIAN & V. VIJAYARAGHAVAN. Language Impairments in an Adult With the Syndrome of Temporal Lobe Contusion.**

There is lack of information on the nature of language impairments in brain injured adults with the syndrome of temporal lobe contusion. Although, previous studies have identified the presence of 'expressive aphasia' (Marion, 1999; McLauren & Helmer, 1965; Nelson et al., 1982), there were no attempts at comprehensive analyses of language performance in such cases. The present study, to our knowledge, is the first attempt to provide a comprehensive description of language performance in an adult with a history of head trauma resulting in the syndrome of temporal lobe contusion. DR, a 45-year old male jail warden, was reportedly assaulted in 11/99 and subsequently diagnosed to have a temporal fracture with hemorrhagic contusion with sub-arachnoid hemorrhage. A CT scan evaluation has confirmed the diagnosis. According to the neurological reports, DR was globally aphasic for a month since the time of the assault. His language improved in the following months. A follow up neurological examination at 20 months post onset revealed the presence of conduction aphasia. DR's language performance was reassessed on 7-15-01. This assessment probed several areas of language, including the following:

1) word repetition and word recognition, 2) word/auditory comprehension, 3) word reading, 4) sentence repetition, 5) sentence construction, 6) finding antonyms for stimulus words, 7) grammaticality judgment, and 8) semantic anomaly judgment. DR's performance was moderate-severely impaired on all these tasks as well as other areas of natural language use (conversation, narrative and procedural discourse). A full-scale neuropsychological evaluation was done following the language evaluation.

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## NEUROPSYCHOLOGY OF MEMORY

### S. BORSUTZKY, E. FUJIWARA, M. BRAND, & H.J. MARKOWITSCH. "Do You Remember Your Christmas Present of 1990?" Confabulations in ACoA and in Korsakoff Patients.

Resulting from frontal lobe lesions, patients with ruptures of aneurysms of the anterior communicating artery (ACoA) and patients with Korsakoff syndrome sometimes tend to confabulate. To examine confabulation tendencies in these patient groups (ACoA patients:  $N = 17$ , Korsakoff patients:  $N = 37$ ) two newly developed neuropsychological instruments were administered: (1) the Confabulation Battery (C-Battery) and (2) the Famous Faces Test with Distractors (FF-Test). The C-Battery contains questions on episodic, semantic and prospective memory and orientation. Furthermore, the battery contains distractor items. These are items that have to be rejected (e.g., "Do you remember your Christmas present of 1990?"). The FF-Test consists of fifteen famous faces and seven unfamiliar faces. Subjects are instructed that they will see only famous persons and are asked what they know about them (e.g., name, profession). In C-Battery, both patient groups were significantly inferior in memory scores compared to healthy controls ( $N = 34$ ). Korsakoff patients showed the weakest memory performance. Regarding confabulations, again both patient groups differed from controls, whereby Korsakoff patients showed the highest number of confabulations. In the FF-Test, only the Korsakoff patients differed from healthy controls, whereas ACoA patients showed no notable impairment. The two tests employed here sensibly and economically detect confabulation tendencies under standardised conditions. They differentiate confabulating from non confabulating patients. Furthermore, patient groups can be differentiated regarding the extent of their confabulations: Whereas in the C-Battery slightly impaired patients already tend to confabulate, in the FF-Test, only patients with marked impairments like Korsakoff patients showed increased confabulations.

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### A. DECROCQ, N. LONGATO, C.A. PHILLIPPS, & L. MANNING. Autobiographical Memory: Its Relationships to Visual Imagery and Emotion.

Autobiographical memory performance could be influenced, among others, by visual imagery and emotion. Concerning the former, the relationship was theoretically suggested in Conway's model (at the Event Specific Knowledge level), with virtually no empirical evidence at hand. Regarding the latter, a general positive correlation between autobiographical memory and emotion has been demonstrated. However, no investigation seems to report on emotional intensity and retrieval of detailed autobiographical recollections. We carried out a correlation study with the aim of obtaining a more comprehensive picture of autobiographical memory, with healthy subjects distributed in three groups of age. Thirty-two participated in the visual imagery experiment and 9 in the emotion study. *Procedure*: Each subject produced a set of 80 autobiographical recollections by means of the Crovitz Test. Scores were based on the richness of details. On the one hand, a test of visual imagery was built. It comprised progressively complete verbal descriptions of 25 items. On the other hand, a 6-point scale reflecting the intensity of the 6 basic emotions was presented. *Results*: No

correlation was found between visual imagery and autobiographical memory (group of age 1  $r = -.27$ ; n.s.; group 2  $r = .09$ ; n.s.). A significant correlation was shown between intensity of emotion and specificity (detail) of recollection ( $r = .51$ ;  $p < .0001$ ). From October to June, our programme is twofold, to expand the number of subjects performing the visual imagery test and to study the two types of eventual associations in brain-damaged patients showing selective impairment to autobiographical memory, visual imagery and emotional experience.

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### S. GINÓ, M. GUERRIERO, & C. GARCIA. Metamemory and Forgetfulness.

*Introduction*: The relationship between metamemory and the performance in memory tests is controversial. *Method*: The authors compare the impression of adult subjects about the efficacy of their own memory expressed on a dichotomic scale (good/not good) with the score on a scale of subjective memory complaints. The performance in memory tests and the loss of the information for intervals of thirty minutes was also compared. *Results*: A sample of 54 healthy subjects without neurological or psychiatric disorders, aged 40 to 86 years and educational level from 0 to 17 years, recruited outside the context of a memory clinic was evaluated. The subjects classified their memory as good or not good. Thereafter they completed the scale of Subjective Memory Complaints (SMC) and their memory was evaluated with two tests (Logical Memory and Associated Learning of the Wechsler Memory Scale) on immediate recall and thirty minutes delayed recall. The subjects were also evaluated with the Geriatric Depression Scale (GDS). A Subjects referring bad memory and with a high score on SMC (presence of memory complaints) were older and had a lower educational level. Our results show that some objective measures of forgetfulness can be influenced by the age, education, and for GDS and they do not reveal important correlations with most of the items from the SMC.

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### H. HOMAYOUN, S. KHAVANDGAR, & M.R. ZARRINDAST. Acute Restraint Stress-Induced Amnesia Linked to Opioidergic and Alpha-2 Adrenergic Systems.

Stressful conditions have modulatory effects on different types of memory. Accordingly, acute exposure to stress prior to training leads to enhanced retrieval of passive avoidance tasks. Among neurotransmitter systems acutely affected by stress, opioidergic and alpha-2 adrenergic receptors are particularly interesting regarding the modulatory role of these receptors in normal learning and memory processing. Interestingly, pre-training administration of opioidergic receptor agonists can induce state-dependent memories that can be retrieved with pre-test opioids. However, the contribution of these mechanisms to stress-induced amnesia is not completely known. To address this question, we used a single trial step-down passive avoidance paradigm in mice. Acute pretraining restraint stress (30 min-2 h) induced a time-dependent impairment in retention. A 2 h pretraining stress was used in subsequent experiments. In mice receiving pre-training stress, pre-test administration of saline did not alter retention impairment induced by stress but pre-test administration of either morphine (1 or 5 mg/kg) or clonidine (0.01 or 0.1 mg/kg), significantly restored the stress-induced amnesia. These doses of morphine and clonidine did not affect retrieval in control non-stressed mice. In a further experiment pre-training morphine (5 mg/kg) induced a significant retention impairment that could be reversed by pre-test stress but not saline. These results suggest that stress-induced amnesia may be a state-dependent learning and retrieval phenomenon involving activation of opioidergic and alpha-2 adrenergic mechanisms.

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**H. HOMAYOUN, S. KHAVANDGAR, & M.R. ZARRINDAST. The Effects of Alpha-2 Adrenoceptor Agonist and Antagonist on Morphine State of Memory in Mice.**

Drugs of abuse including opioids are known to induce state-dependent learning in which a task learned under drug influence will not be recalled unless following pre-test drug administration. This phenomenon may imply the activation of different memory tracks under various conditions may contribute to drug-seeking behaviors in dependent subjects. Opioid-ergic system has many important functional interactions with alpha-2 adrenergic receptors and these two neurotransmitter systems show cross-tolerance in their antinociceptive and some other effects. In this experiment, used passive avoidance training and assessed 24h retrieval in mice. Pre-training morphine (5 kg) impaired retrieval that was not reversible by pre-test saline but was completely reversed by pre-test morphine (5 mg/kg, a dose which did not alter retrieval in control group). Preadministration of the alpha-2 adrenergic agonist clonidine (0.005–0.1 mg/kg) and antagonist yohimbine (0.5–1 mg/kg) in doses which did not affect retrieval in control animals, respectively potentiated and decreased the amnesic effect of pre-training morphine. Thus, morphine state of memory seems to involve activation of alpha-2 adrenergic receptors. In a further experiment, pretraining administration of clonidine (0.2 mg/kg) induced a retrieval impairment which was sensitive to pre-training yohimbine. This clonidine-induced amnesia was unaffected by pre-test yohimbine (0.5 and 1 mg/kg) but was restored by pre-test clonidine (0.01–0.2 mg/kg). This experiment further implies a possible functional link that involve both opiodergic and alpha-2 adrenergic pathways in regulating state-dependent learning and recall mechanisms.

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**S. HORSTMANN, P. CLARENBACH, & H.J. MARKOWITSCH. Memory Processing in Sleep. A Study With Brain-Damaged Subjects.**

The contingency between sleep and memory was examined in brain-damaged patients suffering from memory impairments. Neuropsychological and sleep data were compared between patients with memory impairments and non-brain-damaged control patients. Participants stayed three consecutive nights in the sleep laboratory. The first night served as adaptation for all subjects. For half of the subjects, the second and the third nights were the experimental and the control night, respectively, and for the remaining subjects, the order was reversed. Preceding the experimental night, patients received different memory tasks. In contrast, no memory tasks were given preceding the control night. A comparison of experimental and control nights was intended to reveal the effects of learning on sleep. In order to assess effects of sleep on learning, participants additionally worked on parallel versions of memory tasks in the morning. As expected, the memory promoting effect of sleep was obtained for all patients, but with different magnitudes for the different memory tasks. Additionally, patients with impaired memory performance tended to have more slow-wave sleep than the control patients, and also a higher proportion of slow-wave sleep in the experimental night compared to the control night. In contrast, there were no differences in the duration of REM-sleep between patients with memory impairments and control patients. The results demonstrate that slow-wave sleep is more important for learning and memory than it has been assumed to date.

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**R.P.C. KESSELS & E.H.F. DE HAAN. The Effects of Errorless and Errorful Learning on Age-Related Memory Loss.**

Learning without errors has been found to result in better memory performance in memory impaired patients, compared to standard trial-and-error learning. This principle, however, has been scarcely studied in subjects without cerebral damage. Also, it is unclear whether it taps on residual explicit memory functions or spared implicit memory capacity. Therefore, face-name association learning was examined in 18 healthy older people

and 16 young controls. Subjects were either prompted to guess the correct name during the presentation of photographs of unknown faces (errorful learning) or were instructed to study the face without guessing (errorless learning). The correct name was given after the presentation of each face in both task conditions. Uncued testing followed immediately after the two study phases and after a 10-minute delay. The results showed that errorless learning resulted in higher accuracy than errorful learning. Also, older subjects had an overall lower memory performance and flatter learning curves compared to the young adults, regardless of task condition. These findings might indicate that older people have difficulty in the encoding stages of face-name association learning, whereas retrieval is relatively unaffected. In addition, the prevention of errors occurring during learning results in better memory performance, and is perhaps an effective strategy for coping with age-related memory loss. Finally, the older subjects did not benefit more than the young adults from errorless learning, indicating that the principle does not rely exclusively on spared implicit memory, which was expected on the basis of previous research.

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**S. KHAVANDGAR, H. HOMAYOUN, & M.R. ZARRINDAST. Adenosinergic Activation Contributes to Amnesic Effect of Convulsant Bicuculline in Mice.**

Epileptic patients experience a variety of learning and memory deficits, though the mechanisms involved in these cognitive impairments are not well understood. Animal models of epilepsy provide experimental opportunity to examine these mechanisms. Antagonists of GABA receptors can induce tonic-clonic seizures in rodents that are associated with severe memory impairments. Meanwhile, the adenosinergic transmitter system, which is involved in memory consolidation, becomes activated following seizures. Thus, we examined the possible contribution of adenosinergic activation in the memory impairing effect of acute systemic administration of the GABA receptor antagonist bicuculline in mice. One-trial step-down passive avoidance task with a 24 h interval between training and testing sessions was used in a total of mice. Bicuculline (1 mg/kg) administered 10 min after training induced a significant impairment of memory [median  $\pm$  95% CI, 20.5 (11.01–33.98) vs. 93.4 (56.4–154.5), respectively,  $P < .001$ ] as evidenced by decreased step-down latency on the test day compared to the vehicle-treated group. The adenosine receptor antagonist theophylline (5 and 12.5 mg/kg) was administered 30 min before the training session followed by either bicuculline or the vehicle. Theophylline failed to affect step-down latencies in vehicle groups but dose-dependently inhibited bicuculline-induced amnesia ( $P < .001$ ). Interestingly, the higher dose of theophylline (12.5 mg/kg) could restore the test day step-down latencies of bicuculline-treated animals to the control level seen in vehicle-treated animals [103 (55.69–151.5) vs. 88 (52.91–140)]. Results suggest that activation of the adenosinergic system is involved in the amnesic effect of bicuculline.

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**S. KHAVANDGAR, H. HOMAYOUN, & M.R. ZARRINDAST. Contribution of Nitric Oxide to Morphine-Induced Modulation of Passive Avoidance Memory in Mice.**

The mechanisms through which opioids modulate learning and memory are complicated and involve different pathways. Acute pre- or post-training administration of morphine has impairing effects in different memory tasks. However, some of these impairments like those induced in amygdala-dependent passive avoidance task are reversible by pre-test morphine administration. Recently, many functional links between nitric oxide (NO) and the opioid system have been revealed. In this regard, we assessed the effects of post-training or pre-test administration of NO synthase inhibitor L-NAME or NO synthase substrate L-arginine on the amnesia induced by pre-training morphine in a step-down passive avoidance task in mice. Doses of NO agents which under current experimental con-

ditions did not affect retrieval by themselves were used for evaluation. Pretraining morphine induced a significant naloxone-reversible amnesia that was not sensitive to post-training saline or L-NAME (10 mg/kg) but was inhibited by post-training L-arginine (20 and 60 mg/kg). Moreover, pre-test saline did not affect morphine-induced amnesia but pre-test morphine restored the retention latency to the control level. Pre-test administration of L-NAME dose-dependently decreased the impairment induced by morphine. Pre-test L-arginine had no effect by itself but its combination with L-NAME partially decreased the memory-restoring effect of L-NAME in pre-training morphine group. Results are suggestive of an association between decreased synthesis/release of NO and morphine-induced amnesia and state-dependent learning.

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**B. KÖYLÜ, L. BARTHA, T. EBERHART, E. TRINKA, G. BAUER, & T. BENKE. Selective Spatial Memory Deficits After Right Selective Amygdalohippocampectomy.**

*Purpose:* Deficits in spatial memory processing are common following focal lesions in the right temporal lobe. The aim of this study was to investigate the differential effects of selective amygdalohippocampectomy (SAH) on selective aspects of object location memory, the ability to recognise and recall objects in a visual array. *Method:* The Object Relocation Test was applied in 29 unilateral temporal lobe epilepsy patients who underwent SAH (14 left, 15 right) and 20 age and education matched controls. Assessment procedures included the immediate and delayed recall performance for 10 everyday objects which were presented for 30s within a frame in three different memory conditions (object to location binding, positional memory, combined condition). Two control tasks assessed object identity memory and visuospatial abilities. *Results:* Overall left SAH patients performed inferior to right SAH patients and controls in all subconditions. Significantly poorer performance of the right SAH patients compared to controls was only observed in the positional memory condition ( $p < .01$ ), while differences in object recognition memory, the object to location binding condition and the combined condition did not reach statistical significance ( $p > .05$ ). *Conclusions:* With respect to object location memory, we found further evidence for the critical involvement of right temporal structures in the processing of positional memory, while no specific effects of left sided SAH could be observed. Poor performance in the left SAH group may be a consequence of general memory impairments and not the result of deficits in spatial processing.

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**M. LAUTERBACH, F. RIBEIRO & I. PAVÃO MARTINS. Confabulation of Autobiographical Memories During Transient Global Amnesia (TGA).**

*Introduction:* TGA is a pathological condition characterized by a dense anterograde amnesia and retrograde amnesia of a variable extent. Confabulations are rarely described in this syndrome. *Case Report:* We report the case of a 59 years old woman, JC, who was assessed during an episode of TGA. After the episode three further assessments were performed, showing full recovery from the episode. During TGA, JC revealed severe anterograde amnesia and dense retrograde amnesia. Recovery of anterograde amnesia occurred first, followed by progressively shrinking retrograde amnesia. Recollection of episodic memory was more impaired than that of semantic memory. The most salient feature during TGA was the production of a few "provoked" confabulations for the life periods during "childhood" and "early-adult-life", but not for recent periods, in an autobiographical interview (Kopelman et al., 1989). *Discussion:* Retrograde amnesia during TGA is attributed to a temporary retrieval deficit. The occurrence of confabulations suggests that for the reconstruction and retrieval of past auto-biographical memories, the information must be attached to its circumstantial properties. During TGA, either all the necessary information is not accessible or the components of a memory are

combined in a wrong way. Confabulations seem to overcome the threshold of memory output. Additionally the monitoring of memory output must be defective (Moscovitch & Melo, 1997). The detailed analyses of confabulations during TGA, not usually reported in the literature, contribute to the understanding of the organization of memory and the mechanism of retrieval of remote autobiographical memories.

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**J.F.C. McLACHLAN. Remembering Six Objects: The Naming Test of Memory.**

During the course of their neuropsychological examination, 100 hospital outpatients were asked to name 6 pictures on a single card. Their immediate recall (IR) was incidental memory of the items and their location on the card. Thirty minute delayed recall (DR) reflected intentional memory as well as memory for the location of the items. Both IR and DR were significantly correlated with age as well as with standard tests of memory, i.e., Wechsler Memory Scale-III and Rey Auditory Verbal Learning Test (RAVLT) variables. Regression equations to predict normed performance are reported. The technique offers a brief method of estimating memory function as well as a more detailed approach which combines IR and DR with RAVLT variables for greater precision.

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**C. OROZCO, A. VERDEJO-GARCIA, E. PASTOR-PONS, M. CASTAÑEDA, A. GALDON, J. SANCHEZ, A. ALTUZARRA, & M. PEREZ-GARCIA. Episodic Memory Change After Temporal Lobectomy.**

Temporal lobectomy is an effective alternative treatment for controlling the seizures of the patients with temporal lobe epilepsy. Memory changes are the most frequent consequences of this kind of surgery. Our objective was to study visual and verbal memory changes in a sample composed of 34 temporal lobectomy patients. All the patients were assessed before and after surgery with the Rey Complex Figure Test and the España-Complutense Verbal Learning Test (Test de Aprendizaje Auditivo-Verbal España-Complutense, TAVEC). We carried out Student T analyses for verbal and visual memory variables in left and right temporal lobectomized patients. These analyses revealed no statistically significant change in the memory variables studied. Nevertheless, we have found the existence of several patients with memory deterioration or improvements that are clinically significant (more or equal than a standard deviation). In this way, group analyses do not show the individual variability of our sample, and ignore clinically significant changes in memory. Therefore, in our opinion, these results revealed the importance of adding this individual approach to the group analyses in the neuropsychological study of temporal lobectomy consequences.

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**A. PARK, Y. KANG, M. CHO, & K. KANG. A Validity Study on the Korean-Brief Visuospatial Memory Test (K-BVMT).**

The present study explored the reliability and the validity of the Korean-Brief Visuospatial Memory Test (K-BVMT). The K-BVMT consists of 3 learning trials, delayed recall, recognition, and copy trial. It requires the subjects to recall the shape and the location of 6 different stimulus figures presented one at a time, yielding the figural memory score, the spatial memory score, and the total memory score. We gave the K-BVMT to 104 college students (men: 48, women: 56) along with the Seoul Verbal Learning Test (SVLT), the Rey-Osterrieth Complex Figure Test (RCFT), and other neuropsychological tests. Both the test-retest reliabilities and the inter-rater reliabilities were found to be adequate for all the measures of K-BVMT. The construct validity of the K-BVMT was investigated by factor-analyzing the K-BVMT measures with RCFT and SVLT measures using the principal axis analysis. The oblique rotated analysis revealed that the K-BVMT consisted of 3 different factors, such as general visual

memory, learning rate, and spatial memory. These K-BVMT factors were derived independently from RCFT and SVLT factors. Correlation analyses revealed that most measures of the K-BVMT were correlated more strongly with the RCFT than the SVLT. However, significant correlations were not found between spatial memory scores of the K-BVMT and the RCFT scores. These results confirm the reliability and validity of the K-BVMT as a visual memory test. They also suggest that K-BVMT is a useful tool for assessing various visual memory processes including the spatial memory as well as the figural memory that the RCFT does not assess.

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**N. PAUL, F. MAESTU, J.M. MUÑOZ-CESPEDES, M. RIOS, J. ALVAREZ-LINERA, A. FERNANDEZ, & T. ORTIZ. Correlates of Episodic Memory Encoding: A MEG, fMRI, and Neuropsychological Study.**

In the last few years functional neuroimaging and electromagnetic techniques have delineated the neural basis of some memory processes. However there is still a lack of information about the inter-relations between neurophysiological findings and behavioural assessment. The major aim of the study is to delineate the brain regions responsible for episodic memory formation by combining high-quality localization information provided by fMRI with high-temporal data obtained by MEG. The combination of these techniques allows the establishment of spatiotemporal maps of brain activity underlying encoding processes. The integration of these two techniques with neuropsychological measures allows to study the behavioural correlates of neuro-physiological findings. Fifteen subjects were scanned while encoding a list of auditory-presented words, using different recording techniques: fMRI in one session and MEG in a separate session. Five lists of words were designed for both techniques. Thereafter, participants were asked to retrieve the words. The answers and the retrieval strategies were registered. In addition, a complete neuropsychological assessment was performed. Some WMS-R scores were selected for the statistical analysis. The use of different neurophysiological indexes does permit relating findings in brain activity to the functional state of episodic memory processes. A correlation between both neuropsychological assessment scores and the memory-related activation found is discussed. The activation found in left medial and superior temporal gyrus using MEG is consistent with that found in fMRI during the encoding stages of words. The MEG activity was time dependent showing magnetic sources in the time window between 400 and 800 msec after stimulus onset. Additionally fMRI scan found increased perfusion over the left dorsolateral prefrontal areas. In conclusion, the combination of fMRI and MEG show brain activity profiles that increase the understanding of physiological basis of episodic memory processes.

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**R. SAUR, F. SCHARNOWSKI, & T. KAMMER. Spatial Working Memory: How to Measure Accuracy of Performance.**

**Objective:** In working memory tests, performance is normally assessed in terms of error rates. This is often a crude simplification, especially when testing memory for sequences. We thus developed a method to measure accuracy of performance in a spatial working memory task. **Method:** Twelve subjects looked at a computer screen which was divided into four quadrants,  $11.5 \times 11.5^\circ$  each. In a delayed-response design, subjects were presented with a sequence of one to six dots, each appearing in a random location within one of the four quadrants. After a delay of 5 s, subjects had to reproduce the sequence of the dots as accurately as possible using a joystick. We analysed both the correctness of the sequence (correct quadrant) and the accuracy of the remembered spatial location of each dot. For sequence analysis a modified Levenshtein algorithm was implemented. This algorithm evaluated deletions, insertions, substitutions in the sequences as well as swaps and calculated a correctness term (interval scale).

**Result:** A pronounced load effect occurred for both correctness of sequences and spatial accuracy. Sequence performance declined with increasing load in an exponential fashion. At load 6, only 32% of the sequences were reproduced without error. The Levenshtein correctness term dropped from 100% to 58% only. Spatial accuracy decreased linearly with increasing load from  $0.75^\circ$  (load 1) to  $2.7^\circ$  (load 6). **Conclusion:** The experimental design allows a quantitative approach to working memory performance on a high resolution scale. The Levenshtein algorithm is a promising tool for any sequence analysis problem in psychological tests.

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**M. STOY. Subjective Versus Objective Measures of Memory in Patients With Temporal Lobe Epilepsy (TLE).**

**Objective:** To analyse whether discrepancies between subjective and objective measures of memory can be explained by the lateralisation of the epileptic focus. **Methods:** Fifty-six left TLE-patients (L-TLE, 63%) and 33 right TLE-patients (R-TLE, 37%) were examined with tests on verbal and figural memory and a questionnaire on subjective complaints about memory deficits. A factor analysis extracted three independent memory factors distinguishing verbal, figural and subjective memory. According to this analysis standardised mean scores for verbal, figural and subjective memory were calculated. **Results:** L-TLE and R-TLE-patients did not differ in either verbal or figural memory performance. 18 patients (75%) with a congruent subjective and verbal memory and 22 patients (71%) with a worse verbal than subjective memory belonged to the L-TLE group. In comparison only 16 patients with L-TLE (47%), but 18 patients with R-TLE (53%) belonged to the group with a better verbal than subjective memory ( $\Phi: p < .05$ ). **Discussion:** We were able to identify three independent factors for verbal, figural and subjective memory. There were no material-specific objective memory differences in L-TLE and R-TLE patients. However, especially patients with R-TLE had stronger subjective complaints about memory deficits than their objective verbal memory test results actually revealed. Possible explanations for this result will be reported.

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**L.H. SWEET, S.M. RAO, M. PRIMEAU, A.M. MAYER, & R.A. COHEN. fMRI Correlates of Verbal Working Memory Among Patients With Multiple Sclerosis.**

Verbal working memory (WM) deficits have been a well-replicated finding among patients with Multiple Sclerosis (MS). Recent fMRI studies have described verbal WM systems in healthy samples; however, functional neuroimaging studies of MS patients performing any cognitive task are absent from neuroimaging literature. Fifteen MS patients and 15 age and education matched healthy control participants completed a 2-Back verbal WM task as whole-brain functional MR scans were acquired. Performance accuracy and reaction time did not differ between groups. During the 2-Back task each group exhibited increased brain activity compared to the 0-Back control task in regions associated with the 2-Back in previous neuroimaging studies of healthy samples. These included Broca's area, supplementary motor area, premotor cortex, and dorsolateral prefrontal cortex. MS patients exhibited greater activity than the control group in anterior WM regions and left primary somatosensory cortex. MS patients also exhibited relatively less activation in several subcortical areas. Results suggest that normal performance of a challenging verbal WM task is age associated with hyperactivity in sensorimotor and anterior cortical verbal WM areas among high functioning MS patients. Anterior attentional/executive components of the verbal WM system appeared most affected, while posterior memory storage systems NS appeared unaffected. Reorganization of verbal WM function was not observed in this high functioning patient sample.

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**U. SCHURI, J.M. HUFNAGL, & G. GOLDENBERG. Focal Retrograde Amnesia After Operation of a Left-Sided Sphenoid Wing Meningioma.**

Retrograde amnesia with only minor or without anterograde memory disturbance is a rarely observed performance pattern after brain damage. We report data of patient M.H. who suffered from such "focal" retrograde memory impairment after extirpation of a left-sided medial sphenoid wing meningioma. M.H. performed average or above average on most tests of anterograde memory (the WMS-R index score for General Memory being 110) and executive functions except for subaverage results on face-name-learning, long term retention of verbal facts and verbal fluency tasks. Remote memory tests included two tests of autobiographical memory, a famous faces test, a famous persons test and two tests of general knowledge. Results revealed deficits of episodic as well as semantic memory, with performance being most disturbed on the famous faces test and the famous persons test. There was no obvious time gradient. M.H. profited from retrieval cues and in many cases (given extended time) was able to partially reconstruct target information. Results are discussed with respect to M.H.'s localized pathology of the left anterior temporal lobe, current models of memory storage and retrieval as well as the possible contribution of psychogenic factors.

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**C.J.G. LANG, S.P. HEIDENREICH, R. FAHLBUSCH, & B. NEUN-DÖRFER. Primary Amnesia and Loss of Consciousness in Subarachnoid Bleeding—A Quantitative Retrospective Evaluation.**

Subarachnoid hemorrhages (SAH) constitute about 8% of all strokes. Due to an abrupt change of chemical milieu far-reaching biochemical and electrophysiological changes are induced which may be so severe that up to 20% of patients die before reaching a hospital. Additionally, vasospasm may lead to ischemic brain damage. Since the blood is injected into the CSF under pressure and distributed via convection the damage is widespread. This study was devoted to the frequency and extent to which primary loss of consciousness and amnesia occur in an unselected patient population which was thoroughly questioned including data from relatives and tested with a memory test (Wechsler Memory Scale-Revised, German version). Forty-eight patients having suffered 51 SAHs within one year were assessed personally, 33 women and 15 men, mean age 51.5 years. Thirty-nine percent of them were initially unconscious, but only 10% had retrograde amnesia (duration: 8 minutes to 6 months) extinguishing the onset of bleeding. The modal value of the duration of unconsciousness was 5 minutes, the longest duration 46 days. Two thirds of all patients reported anterograde amnesia lasting between 5 minutes and 5 months. One fifth of the patients reported multiple anterograde amnesias. Memory testing was performed between .5 and 2 years after the SAH yielding results whose mean was in the low normal range. In summary, amnesia and loss of consciousness are frequent events in survivors of SAH, and, although there are similarities to blunt head trauma, differences exist that warrant special consideration.

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**Symposium 15/9:00–10:30 a.m.**

**EXECUTIVE FUNCTION IN  
CLINICAL NEUROPSYCHOLOGY:  
A CRITICAL ANALYSIS**

**Organizer and Chair: Gerald Goldstein  
Discussant: Hallgrim Kløve**

**G. GOLDSTEIN. Executive Function in Clinical Neuropsychology: A Critical Analysis.**

Since Luria introduced the concept of executive function as a disorder of planning, organization, or regulation of behavior, the term has been ap-

plied to characterize cardinal dysfunction in a number of neuropsychiatric disorders, going well beyond Luria's original concept. It has been applied to schizophrenia, autism, attention-deficit hyperactivity disorder, and closed head injury, and as a significant area of dysfunction in children and elderly adults. Nevertheless, correlational and factor-analytic studies have shown that many tests purported to assess executive function are not highly correlated with each other, and are multifactorial. These findings call into question the unity of the concept when broadly defined, and suggest that it represents a number of separable abilities. Studies of high functioning autism have shown that executive dysfunction does not characterize the cognitive profile associated with this disorder for two reasons. First, individuals with high-functioning autism frequently perform normally on the Wisconsin Card Sorting Test (WCST), thought to be a key indicator of executive function. Second, deficits are common in autism that do not involve executive function, even when broadly defined. In the case of schizophrenia, while patients do poorly on such complex executive function tests as the WCST, they also often do poorly on other tests that do not measure executive function. It is proposed that cognitive dysfunction in these disorders are better characterized in a general way as impairment of complex information processing, or as multiple impairments involving the more specific domains of abstract reasoning, attention, and memory.

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**J.C. REED. Executive Functions: A Review.**

This presentation will trace the development of the concept of Executive Functions from the Goldstein-Scheerer Abstract Attitude to the Luria concept of Problem-Solving Skills. Executive functions refer to cognitive processes that include reasoning from cause to effect, discovering the underlying principles that will permit one to solve a class of problems, and those skills required for goal-directed activity, which include activities of daily living. From a neurological point of view, lesions of the frontal lobes disrupt executive functions. From a neuropsychological point of view, there is no agreed upon single test or set of tests that is to be used in the assessment or diagnosis of frontal lobe impairment in the brain-injured patient. Assessment procedures include Diagnostic Interview, the Category Test (standard presentation, booklet form, brief booklet form), the Wisconsin Card Sorting Test, the Porteus Maze, the Tinker Toy Test, the Embedded Figures Test, the Stroop Test, the Trail Making Test, the Tower of London, the combination of Digit Span Reverse, Block Design, Digit Symbol, and many other tests. However, the correlation coefficients between and among these various measures are no more than modest, which indicates either a lack of precision in the neuropsychological assessment of frontal lobe functions or the ambiguity of the concept of Executive Functions or both. The ecological validity of neuropsychological tests is highly variable, and is dependent upon the specific test and specific behavior being assessed. The presentation will address the foregoing problems with reference to specific studies, factor analyses, and reports of case studies with individual patients. Emphasis will be placed upon the distinction between assessment of the individual patient and the need for a rigorous operational definition of Executive Functions in research investigations.

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**G. GOLDSTEIN. Executive Dysfunction in High Functioning Autism (HFA).**

While the cognitive profile found in high functioning autism (HFA) (IQ > 70) has been characterized as representing a cardinal deficit in executive function, current evidence does not support that conclusion. There are two areas of difficulty. Numerous studies using the Wisconsin Card Sorting Test indicate that a substantial number of individuals with HFA perform normally. One study has shown that even when performance was abnormal when the test was administered by a person, it became normal when it was computer-administered. Individuals with HFA have cognitive deficits but the profile cannot be characterized as reflecting executive dysfunction specifically, even when broadly defined. As exam-

ples, they have substantial difficulty with reading comprehension and metaphoric use of language. We have shown that they do not have a general deficit in abstract reasoning, but they do have a deficit in concept formation, defined as the ability to self-initiate problem solving strategies to reach a solution. Thus, they do poorly on free sorting tasks in which they must initially formulate and shift hypotheses to reach a solution, but they may do well on concept identification tasks, such as the WCST or Category Test, in which the task is to learn a pre-established concept. Their cognitive profile is better characterized as a disorder of complex information processing than as one of executive dysfunction. This conceptualization is consistent with neurobiological evidence suggesting that autism is a widespread neural system disorder rather than a specific disorder of the frontal lobes.

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#### **D.N. ALLEN. Executive Dysfunction in Schizophrenia.**

Executive dysfunction has been characterized as a cardinal area of cognitive dysfunction in schizophrenia primarily on the basis of production of abnormally large numbers of perseverative errors on the Wisconsin Card Sorting Test (WCST). This finding has been associated with reduced blood flow in the frontal lobes of patients with schizophrenia. This evidence, while indicative of perseverative rigidity in many individuals with schizophrenia does not establish that executive dysfunction is an essential core deficit. There are two considerations here. First, studies of large samples of patients with schizophrenia have identified a "neuropsychologically normal" group. These individuals, while meeting all diagnostic criteria for schizophrenia, do not make numerous perseverative errors on the WCST, and often perform completely normally. Second, patients with schizophrenia characterized by cognitive impairment often exhibit the "general deficit syndrome" incorporating impairment in numerous cognitive domains, and not just those that assess executive function. Thus, characterizing executive function as a cardinal deficit is insufficiently inclusive, since what is estimated to be about 20% of the schizophrenia population does not exhibit this deficit, and overly exclusive because executive dysfunction does not characterize numerous areas of cognitive dysfunction that commonly occur in schizophrenia.

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**Symposium 16/9:00–10:30 a.m.**

### **COMPREHENSIVE ASSESSMENT OF PATIENTS IN COMA, IN THE VEGETATIVE STATE, AND IN THE MINIMALLY CONSCIOUS STATE: A BEHAVIOURAL, NEUROPHYSIOLOGICAL, AND IMAGING APPROACH**

**Chair: J.D. Pickard**

**Organizer: Agnes Shiel**

**Discussant: J.D. Pickard**

#### **A. SHIEL. Comprehensive Assessment of Patients in Coma, in the Vegetative State, and in the Minimally Conscious State: A Behavioural, Neurophysiological, and Imaging Approach.**

Traditionally, assessment of behaviour—or lack of it—has been used to diagnose patients as being in coma, the vegetative state and more recently in the minimally conscious state. Given the importance attached to these labels in terms of predicting outcome, referral to rehabilitation and planning future management, this approach is limited. In this symposium we address this issue and describe a comprehensive approach to assessment

of these patients using behavioural assessment and neuroimaging and neurophysiology. The first paper shows that while behavioural assessment still provides valuable information, manipulation of the patients environment in terms of their position and posture can alter the results of behavioural assessments significantly. Two papers address the potential of neuroimaging in clarifying the levels of residual function where there is little if any behavioural evidence of cognition and the fourth paper describes the relationship between neurometabolic coupling and results of behavioural assessment in patients who are still in coma. Extending approaches to assessment of these patients is essential. It ensures more complete information is available to those treating these patients making medical and ethical decisions as to their future management.

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#### **A. SHIEL, R. O'CONNELL, L. ELLIOTT, L. HOOPER, B. WILSON, D.K. MENON, & J.D. PICKARD. The Effects of Different Postures on Levels of Arousal in Patients in Coma and in the Vegetative State.**

Posture is known to affect levels of arousal in people without brain injury. For example, sleep deprived subjects' ability to remain awake was shown to be best while standing and changes in EEG activity caused by sleep loss were attenuated when subjects stood. Patients in coma and in a vegetative state are usually assessed lying in bed and the effects of posture and position on levels of arousal have not been investigated. A series of single case studies was carried out on patients defined as being in coma or in a minimally conscious state. Levels of arousal were assessed using the Wessex Head Injury Matrix (WHIM) lying in bed, standing upright in a frame and afterwards. All patients showed increased arousal in standing and this effect was most marked with those in coma. Two patients in a chronic vegetative state were also studied. Of these, one showed a slight effect and the other remained unchanged. While standing upright, patients who are in coma or minimally conscious showed significant improvement in objective tests of arousal and cognition and motor function. Furthermore these effects have been observed to last for some hours. This finding has enormous implications not only for the immediate benefits of standing but also for patients' potential response to other therapies carried out immediately afterwards.

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#### **A. OWEN, D.K. MENON, & J.D. PICKARD. Using Functional Neuroimaging to Detect Residual Cognitive Function in Persistent Vegetative State (PVS).**

Despite converging agreement about the definition of persistent vegetative state, recent reports have raised concerns about the accuracy of diagnosis in some patients, and the extent to which, in a selection of cases, residual cognitive functions may remain undetected. Objective assessment of residual cognitive function can be extremely difficult since motor responses may be minimal, inconsistent, and difficult to document in many patients, or may be undetectable in others because no cognitive output is possible. Here we describe strategies for using H2 15O positron emission tomography activation studies to study covert cognitive processing in patients with a clinical diagnosis of persistent vegetative state. Three cases are described in detail. Of these, two exhibited clear and predicted regional cerebral blood flow responses during well documented activation paradigms (face recognition and speech perception) which have been shown to produce specific, robust and reproducible activation patterns in normal volunteers. Some months after scanning, both patients made a significant recovery. In a third case, blood flow data was acquired during a speech perception task, although methodological difficulties precluded any systematic interpretation of the results. In spite of the multiple logistic and procedural problems involved, these results have major clinical and sci-

entific implications and provide a strong basis for the systematic study of possible residual cognitive function in patients diagnosed as being in a persistent vegetative state.

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**F. MANES, L. SIGMAN, S. CARPINTIERO, T. TORRALVA, L. SABE, L. OLMOS, & R. LEIGUARDA. Recognition of Familiar Faces and Voices in Persistent Vegetative State Studied by fMRI: Implications for the Neural Mechanism of Consciousness.**

**Objectives:** Blocked design fMRI was used to investigate cortical activation specificity in PVS cases: a) after presenting familiar *versus* unfamiliar faces, and b) after a familiar voice reading an emotional text *versus* an unfamiliar voice reading an unemotional text. **Patients and Methods:** Experiment 1: Familiar faces and blurred unrecognisable images of the same, followed by familiar faces *versus* unfamiliar faces were shown in a block design on a computer screen, to a 55-year-old woman in PVS. Experiment 2: A 17-year-old man in PVS listened to his mother reading an emotional text and an age-matched voice reading unemotional text. **Results:** Experiment 1: Subtraction of familiar faces from blurred unrecognisable images of the same showed a significant focus of activation in the right inferior temporal gyrus and right occipitotemporal cortex. Subtraction of familiar from unfamiliar faces showed a significant focus of activation in the posterior part of the right inferior temporal gyrus and in the medial left temporal gyrus. Experiment 2: There was a significant focus of activation in the left orbitofrontal cortex and in the left auditory cortex. **Conclusions:** Showing familiar faces to PVS patients has an impact on brain regions normally involved in face processing, with anatomical evidence for response specificity. The left orbitofrontal cortex appears to play a role in the response to an emotionally charged voice.

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**M. COLEMAN, A. SHIEL, T. FRYER, L. GELLING, D. MENON, B. WILSON, J.D. PICKARD, & S. BONIFACE. Emergence From Coma May Depend on the Integrity of Neurometabolic Coupling.**

**Object:** Some brain injury patients regain consciousness slowly following withdrawal of sedation. Understanding why recovery is slow (if at all) is very limited. The aim of this study was to investigate the relationship between the integrity of neurometabolic coupling (the homeostatic link between neuronal electrical activity and cerebral metabolism) and patients' behavioural ability. **Methods:** Five heterogeneous patients (3 female: mean age 58.4, range 41–80 years) were studied 11–30 days after withdrawal of sedation. Each was studied with positron emission tomography (PET) using an 18F-fluorodeoxyglucose protocol. Immediately after, an electroencephalogram (double-banana montage) was obtained (bandpass 0.1–70 Hz). Using in house software spatially normalised maps of the cerebral metabolic rate of glucose utilisation were calculated. The correspondence between neuronal electrical activity and cerebral glucose metabolism was analysed using the method of Leuchter et al., (1999). Behavioural ability was assessed using the WHIM on the day of scanning and four weeks later. **Results:** The integrity of neurometabolic coupling was strongly related to each patient's behavioural ability on the day of investigation and 4 weeks later. However, when measures of neuronal electrical function or cerebral metabolism were individually compared with WHIM scores, neither showed any association. **Conclusions:** These findings provide a new insight into the patho-physiological sequelae of coma suggesting the important homeostatic relationship between electrical function and cerebral metabolism may be related to recovery. Such findings highlight the need for neuroprotective strategies, which target the integrity of neurometabolic coupling.

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**Paper Session 17/9:00–10:30 a.m.**

**NEUROPSYCHOLOGICAL REHABILITATION**

**M.I. GREGOROVA. EEG Biofeedback in the Treatment of Traumatic Brain Injury.**

This study was on the clinical application of EEG biofeedback as a treatment strategy for traumatic brain injury. Thirty participants were trained in EEG biofeedback to increase Beta3 and decrease Theta wave activity. The hypotheses were that EEG biofeedback would be associated with improvement in attention, concentration and emotional functioning. Subjects received pretest and posttest evaluation with neuropsychological measures of attention, verbal fluency and the Symptom Checklist-90 for the assessment of emotional functioning. **Results:** The participants in this study were successful in increasing Beta wave and decreasing Theta wave activity following 31 sessions of EEG biofeedback. Statistically significant improvement was indicated for attention-concentration and emotional areas. **Conclusion:** EEG biofeedback appears to be an effective means of neurotherapy in traumatic brain injury.

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**R. KASCHEL, S. DELLA SALA, A. CANTAGALLO, A. FAHLBÖCK, R. LAAKSONEN, & M. KAZÉN. Transfer and Generalisation in Memory-Rehabilitation: Evidence From Experimental Single-Case Designs.**

Whereas group-designs can demonstrate the efficacy of memory training, single-case designs seem more appropriate to answer questions about generalisation to non-trained materials and transfer to everyday-life. Although there are numerous studies on memory training, studies assessing its generalisation and transfer are sparse. To investigate this question we used an A-B-A-plus multiple-baseline design in a study applied to mildly memory-impaired patients who received visual-imagery memory training. Generalisation was measured using psychometric tests applied a number of times (before & after the baseline, after imagery training, after transfer to a specific verbal/prospective memory problem, and after 3 months, as follow-up). Diaries and questionnaires were used to monitor critical memory lapses and thus tapped the pattern of transfer to everyday situations. Concerning the first question, a generalisation gradient became evident: Effects were more robust if enough time was enabled to encode and retrieve verbal material, thus mimicking the training situation (e.g., better remembering of appointments but no improvement in recall of radio news after visual-imagery training of everyday actions). Transfer to everyday situations was only seen directly after the transfer of the imagery strategy to individual prospective and verbal-memory situations. Single-case statistics indicated that improvements were reliably related to this direct transfer in all 9 patients. The finding that patients do not transfer a strategy spontaneously suggests that such a transfer intervention should become the final step of memory training procedures.

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**I. KELLER. Neurofeedback Therapy of Attention Deficits.**

Impairments of attention are a frequent and well documented consequence of head injury. The purpose of this study was to evaluate if Neurofeedback Therapy (NFT) can enhance remediation of attention deficits in patients with closed head injuries (CHI) who are still in the phase of spontaneous recovery. EEG-feedback of beta-activity (13–20 Hz) was used for the treatment of attentional impairments in twelve patients with moderate closed head injuries. A matched control group of nine patients was treated with a standard computerized training. All patients were tested before and after treatment with a set of attention tests. After ten sessions the analyses of beta activity showed that eight patients were able to increase their beta activity while the remaining four patients showed a decrease of beta activity. Mean duration of beta activity was prolonged about 50% after



training in the NFT group but not in the control group. Patients who received NFT improved significantly more in the attention tests than control patients, especially in sustained attention tasks. It is suggested that NFT may be seen as a method to restore the mechanisms that underlies the management of rhythmic brain activity demonstrating thereby the brain's capacity for restoring homeostasis. Neurofeedback is therefore a promising method for the treatment of disorders of attention in patients with traumatic brain injuries. The results indicate that NFT should focus not only on the enhancement of beta activity, but also on the duration patients are able to sustain beta activity.

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#### **K. THICKPENNY & S. BARKER-COLLO. Evaluation of a Structured Group Format Memory Rehabilitation Program for Adults Following Brain Injury.**

Memory impairments commonly follow traumatic brain injury (TBI) and cerebral vascular accident (CVA), and have a profound impact on the capacity to engage in rehabilitation and independent living. This study evaluated the effectiveness of an 8-session structured group format memory rehabilitation program for adults following TBI and CVA. Fourteen participants aged 16 to 50 years were randomly assigned to wait-list control and experimental conditions. Neuropsychological assessments of memory and memory-related performance (i.e., verbal recall, visual recall, attention), and measures assessing functional and everyday memory were administered before the wait-list (where applicable), before treatment, after treatment, and at one-month follow-up. Results indicate that participation in the Memory Group significantly increased participants' knowledge of memory and memory strategies; significantly increased participants' use of memory aids and strategies as rated by participants and significant others; and significantly reduced behaviours indicative of memory impairment as rated by participants and significant others. Participation in the Memory Group also had a positive effect on participant performance on selected neuropsychological assessments of memory and memory related performance (i.e., California Verbal Learning Test: Long Delay Free Recall; Visual Paired Associates: Delayed; and Logical Memory: Immediate and Delayed). All the significant improvements outlined above exceeded those experienced by wait-list controls. The positive effects of the group were maintained one-month after participation in the group.

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#### **A.I.T. THÖNE-OTTO, K. WALTHER, & H. SCHULZE. MEMOS—Evaluation of an Interactive Electronic Memory Aid for Brain-Injured Patients.**

During the last several years electronic memory aids have gained increasing importance in the compensation of everyday memory problems (e.g., Wade et al., 2001; Wilson et al., 1997; van den Broeck et al., 2000). The most important function of these instruments is to remind patients of their intentions at the right time, while data entry is done by a relative or therapist. Due to the fact that these mobile memory instruments have a receiver function only, and no interaction with the server, they cannot help patients through the execution of an intended action nor do they have the possibility of postponing intentions, if necessary. MEMOS is a new internet based and interactive memory aid, which involves the opportunity of online communication between patient and server. In addition speech input makes data entry very easy, thus patients are able to enter new intentions without being dependent on others. We present the first data of an evaluation study with 12 brain injured patients with mild to moderate memory problems. Indicators of success were: a) progress during training b) number of experimental tasks successfully executed during baseline and treatment c) number of everyday intentions entered by the patient d) number of everyday intentions successfully executed during baseline and treatment and e) patients' satisfaction with the usefulness measured with a questionnaire. Results will be related to severity of memory deficits and

compared to the results of a former study in which we examined the usefulness of commercially available memory aids (Thöne-Otto & Walther, 2002).

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#### **B. WILSON, H. EMSLIE, J. EVANS, & P. WATSON. A Paging System for People With Traumatic Brain Injury (TBI).**

Although memory problems following acquired brain damage are common, some people are able to compensate for these problems through external aids. We recently demonstrated that a paging system could reduce the everyday memory and planning problems for people with non-progressive brain injury (Wilson et al., 2001). The 143 patients who participated in the study comprised several diagnostic groups. In this paper we report on the subgroup of people with TBI ( $N = 63$ ). A randomised control crossover design randomly allocated people to group A (pager first) or group B (waiting list first). Each participant chose their own tasks for which they needed reminders. During a two week baseline successful task achievement was documented. Group A achieved 47.14% of tasks and group B 47.88%. People in group A then received a pager for 7 weeks. During the last two weeks of this 7 week period, task achievement was documented again. Group A now achieved 71.80% of tasks and group B (on the waiting list) achieved 49.05% (no different from baseline). Group A then returned their pagers and group B received pagers. During the last two weeks of this stage participants were monitored once more. At this point people in group A had dropped back slightly but were still significantly better than during the baseline (67.23%). Group B, meanwhile were now achieving 73.62% of tasks. This was significantly better than baseline and significantly better than group A at the same stage. We conclude that this paging system significantly reduces the everyday memory and planning problems of people with TBI.

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### **Paper Session 18/9:00–10:30 a.m.**

#### **MEDICAL NEUROPSYCHOLOGY**

#### **A.M.A. BRANDS & R.P.C. KESSELS. Cognitive Decline in Type 1 Diabetes Mellitus.**

Diabetes Mellitus (DM) is associated with gradually developing end-organ damage to the central nervous system, expressed by electrophysiological changes, cerebral atrophy and white-matter lesions, and cognitive disorders. Several studies in type 2 DM ("non-insulin dependent") show impairments in memory and complex information processing, especially in elderly patients. Also, recent epidemiological studies show a relation between type 2 DM and both vascular and Alzheimer's dementia. However, results on type 1 DM ("insulin dependent") are less clear, since most studies are limited to adults under the age of 55. Therefore, the aim of this ongoing study is to assess cognitive decline in the elderly patient with type 1 DM. So far, thirty-two type 1 DM patients aged 52 to 77 ( $M = 59.7$ ), recruited from two general hospitals (Woerden and Gouda), were examined using a comprehensive neuropsychological test battery. Both tests known to be particularly influenced by type 2 DM (memory, complex attention, executive function) and tests known to be relatively undiscriminatory (basic attention and speed of information processing) were selected. The results indicate that a substantial percentage of these patients show impairments especially on delayed memory tests, concept shifting, complex attention and fluency tasks. This is consistent with previous results on type 2 DM, and might possibly be the result of hippocampal and frontal-lobe dysfunction. Furthermore, the patients show high levels of somatic and psychological problems (SCL-90), but have low scores on

depression (BDI). Possible moderator variables are hypertension, HbA1c, age at onset, hypoglycaemic episodes and psychological distress.

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**R.O. HOPKINS, D. COLLINGRIDGE, L.K. WEAVER, K. CHAN, & J.F. ORME, JR. Neuropsychological Sequelae Following Acute Respiratory Distress Syndrome: Two Year Outcome.**

**Background:** Acute Respiratory Distress Syndrome (ARDS) is an acute lung injury, manifest by arterial hypoxemia often requiring mechanical ventilation with a mortality rate of approximately 30%. Survivors of ARDS have cognitive deficits (Hopkins et al., 1999) and brain atrophy and ventricular enlargement may occur (Hopkins et al., 2000). Neuropsychological outcome beyond one year is largely unknown. The purpose of this study was to assess neuropsychological outcome two years after onset of ARDS. **Methods:** Seventy-eight consecutive ARDS survivors were evaluated for this study; data was collected for 71 patients at hospital discharge, 66 at 1-year and 62 at two years post ARDS. All subjects were administered a neuropsychological test battery at all three time intervals. Continuous measurement of hypoxemia (SaO<sub>2</sub>) and blood pressure were automatically recorded during the ICU course. **Results:** At one year 59% had cognitive impairments and 43% at two-years on at least 2 cognitive domains (>1.5 SD). Neuropsychological performance at hospital discharge was lower than one and two years after ARDS onset ( $p < .001$ ). There was no difference between one and two-year outcome. There was no effect of gender or type of ventilator treatment. Neuropsychological outcome correlated with duration of arterial hypoxemia for digit span, RAVL5, Trails B at hospital discharge, RAVL1, and Trails A at one year, and digit span and digit symbol at 2 years. There was no relationship between mean blood pressure and neuro-psychological outcome. **Conclusions:** ARDS results in significant cognitive sequelae, that persists to 2-years after hospital discharge, and impairments are related to episodes of arterial hypoxemia.

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**E. LOJEK & R.A. BORNSTEIN. The Utility of the WAIS-R in the Neuropsychological Evaluation of HIV+ Subjects.**

Although there is increasing evidence that HIV-related neuropsychological (NP) dysfunction significantly affects day-to-day functioning, the relationship between specific patterns of NP performance and different dimensions of quality of life has not been systematically studied. Two hundred seven HIV+ participants and 77 HIV- controls completed assessment on a comprehensive NP battery and The Sickness Impact Profile (SIP) as a measure of everyday functioning. Cluster analysis was used to divide HIV+ subjects regarding specific patterns of their NP functioning. Five profiles of NP were obtained: 1) no cognitive deficits, 2) learning and memory dysfunction, 3) slowness of psychomotor processes, 4) impairment of abstract thinking, 5) concurrence of various neuropsychological dysfunction. The most severe NP changes were marked in HIV+ subjects characterized by the profiles number 1, 3 and 5. The research confirmed the connection between neuropsychological functions and the quality of life of people infected with HIV. The most serious problems with managing in everyday life were observed in HIV+ clusters with severe cognitive dysfunction. HIV-positive men who were not neuropsychologically different from HIV-seronegative men did not display any dysfunction in their everyday lives. The weakening of cognitive abilities reduces the efficiency mostly at one's job, but it also involves difficulties with concentration in everyday life, poorer efficiency in psychosocial functioning, sleeping problems and weariness. The factors that significantly influence future quality of everyday life in HIV-infected people were as follows: the level of overall neuropsychological impairment, speed of information processing, spatial abilities and categorical thinking.

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**J. LUCAS, L. RILLING, R. WHAREN, M. TURK, J. PUTZKE, & R. UTTI. Cognitive Functioning in Patients With Essential Tremor.**

Essential tremor (ET) is traditionally considered a "benign" condition not associated with other neurological impairment or cognitive deficits. Contrary to this view, two recent studies have identified neuropsychological impairments suggesting possible frontal system dysfunction. The small samples employed by those studies, however, limit their generalizability. We examined neurocognitive functioning in a larger sample of 53 (28M, 25F) patients diagnosed with severe, medically intractable ET. Patients underwent neuropsychological studies as part of a baseline assessment prior to surgical treatment of tremor. The mean age of the sample was 69.6 years (SD = 11.2). The test battery included measures of expressive language, visual processing, attention, learning, memory, executive function, and psychomotor speed. Raw scores were converted to age-corrected scaled scores and compared to the expected normal distribution. Results revealed that a significantly greater than expected proportion of ET patients obtained scores in the impaired range (<1 SD) on measures of processing/motor speed, verbal fluency, divided attention, and verbal retrieval. The proportion of patients with impaired performances on measures of confrontation naming, visual processing, and auditory-verbal attention did not differ significantly from that expected in the neurologically normal population. ET patients demonstrated a similar cognitive profile to that of an age- and education-matched sample of 40 patients with Parkinson's disease (PD). PD patients, however, were more significantly impaired than ET patients on measures of semantic fluency and verbal learning. Results support the hypothesis that patients with ET demonstrate neuropsychological deficits suggestive of frontal system dysfunction that is similar to, but milder than, those observed in PD.

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**A. SCHEURICH, M.J. MÜLLER, A. SZEGEDI, I. ANGHELESCU, C. KLAWE, B. LÖRCH, B. KAPIS, H.G. BIALONSKI, S. HAAS, & M. HAUTZINGER. Neuropsychological Status of Recently Detoxified Alcohol Dependent Patients: Functional or Motivational Limitations?**

**Background:** Alcohol dependency is associated with neuropsychological impairment and motivational deficits which might have mutual effects. Recent theories describe negative influences on motivational self-regulation through executive deficits, and motivation possibly influences neuropsychological results. Previous studies found higher test performance with monetary reward but could not demonstrate any influence on testing results through experimental instructions inducing higher achievement motivation in alcohol dependent patients. **Method:** 60 alcohol dependent patients after detoxification and 60 carefully matched healthy control subjects underwent neuropsychological investigation. The goal-setting paradigm was used to systematically manipulate motivation. Participants were requested to calculate simple mathematical problems repeatedly within phases of a two minute duration receiving normal or goal setting instructions (to increase performance in the next phase by 20%). **Results:** The patients with goal setting instructions displayed significant improvement in the amount of correct responses, the total number of completed calculations and reaction time ( $p < .05$  each). Interaction of group (patients vs. control subjects) and instructions (goal setting vs. normal) remained insignificant ( $p = .49$ ) indicating that the increase through goal setting for the patients was not significantly higher than that for the control subjects. **Conclusions:** In contrast to previous investigations a significant increase in test performance for alcohol dependent patients with enhanced achievement motivation through experimental instructions was demonstrated. Our results do not support the hypotheses that motivational deficits could be a causal factor for cognitive limitations. However, motivational resources of alcohol dependent patients and a technique to enhance achievement motivation and test performance was shown.

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**K. SUNDET, C. LUND, P.K. HOL, R. LUNDBLAD, E. FOSSE, B. TENNØE, R. BRUCHER, I. REINVANG, & D. RUSSEL. Neuropsychological Impairment in Groups of Coronary Artery Bypass Patients Operated On-Pump and Off-Pump.**

Coronary artery bypass grafting (CABG) with the standard on-pump cardiopulmonary bypass (CPB) procedure may have adverse effects on the brain. Studies report 10–50% risk of neuropsychological impairments post surgery depending on follow-up time. Off-pump surgery has been introduced as an alternative procedure with an assumed lower cognitive risk factor. We present results from an on going study designed to compare outcome at 3 and 12 months post CABG surgery with half the group randomly assigned to on-pump and half the group to off-pump treatment. 120 patients participated. A subsample of 52 patients was monitored with transcranial Doppler (TCD) during surgery to register number of microemboli entering the brain. 7 patients assigned to off-group surgery were forced to convert to standard on-pump procedure during operations. Demographic characteristics did not differ between groups (age: 65 years; education: 10 years; male: 77%; FSIQ: 102). Test scores were factor analysed into 8 cognitive components (motor speed, reading speed, auditory attention, verbal memory, memory interference, verbal knowledge, visuospatial ability, executive function). No significant group by time interactions were found on any of the components. By counting the number of subjects who scored in the impaired range on at least one of the 8 components, incidence rates between 10% and 20% were found in both groups. No significant correlation was found between number of microemboli and mean change in neuropsychological performance. The results confirm an increased risk for developing minor neuropsychological deficits following bypass surgery, but the risk factor is not caused by the on-pump procedure alone.

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**Symposium 17/11:00 a.m.–12:30 p.m.**

**NEUROPSYCHOLOGICAL TOXICOLOGY:  
NEUROBEHAVIORAL ASSESSMENT  
OF EXPOSURE TO POTENTIALLY  
NEUROTOXIC COMPOUNDS**

**Organizers: Martin Peper and Gerhard Winneke**

**M. PEPER & G. WINNEKE. Neuropsychological Toxicology: Neurobehavioral Assessment of Exposure to Potentially Neurotoxic Compounds.**

Humans exposed to neurotoxic chemicals may exhibit alterations in psychomotor, cognitive and/or affective functioning and may also report a wide range of symptoms. The multidisciplinary field of neuropsychological toxicology provides a framework for the systematic assessment and interpretation of adverse effects. In particular, exposure to metals, solvents, pesticides and persistent polyhalogenated hydrocarbons (as, e.g., dioxins, furans, PCBs, etc.) has increasingly raised public health concerns. Exposure to air-borne substances is also a matter of interest since indoor air pollution may affect a large number of people both in the workplace as well as in home and public environments (e.g., schools, hospitals, etc.). This symposium provides an overview of current research and discusses methodological problems associated with the assessment of the neuropsychological effects of exposure to different classes of chemicals with neurotoxic properties. Recent work indicates that methodological advances have been achieved by improving analytical procedures, by applying computerized test batteries, by identifying profiles of behavioral changes and

symptoms, as well as by utilizing longitudinal study designs and associated advanced modelling approaches. These contributions show that neuropsychological toxicology provides important methods for the assessment of the potential behavioral, cognitive and emotional changes related to neurotoxic chemicals. It is, thus, an indispensable source of information for assessing subtle health effects in the individual and, eventually, for rehabilitation, risk assessment and prevention.

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**G. WINNEKE. Behavioral Neurotoxicology: Introduction and Overview.**

Neurotoxicology draws upon a broad spectrum of neuroscience methods, such as neuroanatomy, neurochemistry, neurophysiology, neurogenetics, or neuropharmacology to study adverse effects of chemicals on structure and function of the mature or developing nervous system. The neurobehavioral approach is part of this spectrum. The study of behavior and its reversible or irreversible modification by chemicals or therapeutic agents in toxic doses is a relatively new approach within neurotoxicology. Adding the prefix “neuro” to behavior has been proposed to emphasize this link with the other neurosciences. Although the term “neurobehavioral toxicology” covers both animal and human approaches, it has become customary to use the term “behavioral toxicology” for animal models and the term “neuropsychological toxicology” for the behavioral consequences of human exposure settings. This symposium will exclusively cover the field of neuropsychological toxicology. In the introduction, a brief overview of relevant classes of chemicals with neurotoxic properties will be given, and fundamental principles of toxicology as well as main methodological issues will be discussed. Particular emphasis will be placed on the problem of drawing causal inferences from associations using the well-known Bradford-Hill criteria. The potential danger of not clearly distinguishing between unexplained medical symptoms in diverse environmental syndromes (e.g., CFS, SBS, MCS) on one hand and symptom reporting in neurotoxicity studies on the other will be emphasized.

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**M. PEPER & M. KLETT. Neurobehavioral Assessment of Long-Term Low-Dose Exposure to Polychlorinated Compounds.**

The potential long-term health effects of low-dose exposure to neurotoxic substances in non-industrial environments such as private homes are poorly investigated. The present contribution presents an overview of three cross-sectional group studies focussing on the neurobehavioral toxicity of chronic low exposure to selected polychlorinated compounds. Complaint questionnaires as well as neuropsychological tests of memory, attention and psychomotor functions were applied. Exposure was verified through biological monitoring and measures of external exposure. Matched control groups were also available. In the first study, the effects of exposure to air-borne polychlorinated biphenyls (PCBs) originating from elastic sealants were investigated. The study group of 30 persons exposed to PCBs differed significantly from controls with respect to the congeners 28 and 101. No clear evidence for a chronic neuropsychological toxicity was found. Nevertheless, weak to moderate effect sizes were found for health complaints and concentration difficulties as well as for computerized tests of attentional functions. In the second study, the effects of indoor exposure to wood preserving chemicals containing solvents, pentachlorophenol and lindane were investigated in 15 women. The exposed group described more complaints and differed significantly from controls on measures of working memory and short term retention. In the last study, we reanalysed our data from an environmental contamination by dioxins and furans due to pyrolytic processes. Nineteen randomly selected persons exposed in



their home environment were mostly within the expected range, but memory performance was poorer as compared to controls. These studies are discussed with respect to dose-response relationship, confounding variables and causality.

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#### **J. WALKOWIAK & G. WINNEKE. Psychodevelopmental Neurotoxicity of PCBs.**

There is debate and concern about adverse neurodevelopmental effects of PCBs at environmental levels of exposure. Our cohort study deals with this issue. Its purpose was to distinguish between the developmental impact of pre- and postnatal lactational exposure to PCBs at current background levels for psychodevelopment in children, to compare the stimulating effects of a supportive home environment with the presumably adverse PCB-effects, and to check for the persistence of PCB-associated developmental delay until school entry. For this study, 171 healthy mother-infant pairs were recruited. Prenatal PCB-exposure was estimated from congeners 138, 153 and 180 in cordblood and milk. At 42 months of age PCB-concentrations were measured in serum additionally. Between 7 and 42 months of age psychodevelopment was tested repeatedly, using the Bayley Scales (BSIDII) at 7, 18 and 30 months of age, as well as at 42 and 72 months by means of the Kaufman Test (K-ABC). Statistical evaluation was done by means of linear regression-modelling, emphasizing the home environment (HOME). A significant negative association between PCBs in early human milk and mental/motor development was found at 30 and 42 months of age. In addition to this primarily prenatal effect adverse psychodevelopment at 42 months of age was also found to be associated with postnatal PCB-intake through nursing. However, at 72 months the association between PCB-levels and K-ABC performance was no longer seen. Significant positive associations between HOME and cognitive development were found at 30, 42, and 72 months of age. This study illustrates both the strength of longitudinal designs in psychological toxicology, and the vulnerability of the developing brain relative to the mature brain to chemical insult.

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#### **H. VREUGDENHIL & N. WEISGLAS-KUPERUS. Perinatal Exposure to Polychlorinated Biphenyls (PCBs) and Dioxins and Neurodevelopmental Outcome in Dutch Children.**

Effects of perinatal exposure to polychlorinated biphenyls (PCBs) and dioxins on neurodevelopmental outcome has been assessed in children from the Dutch PCB/dioxin cohort, a cohort of healthy born children ( $n = 418$ ), from birth to school age. 209 Children were breast-fed and 209 were formula-fed during infancy. Prenatal exposure to PCBs was defined as the sum of four PCB congeners (PCB118, 138, 153 and 180) assessed from maternal and cord plasma and breast-milk. Breast milk samples were analyzed for additional PCB congeners as well as dioxins. Higher prenatal PCB exposure was related to a poorer neurological condition at birth and at 18 months of age, lower psychomotor scores at 3 months and lower cognitive functions at 31/2 years of age. Postnatal PCB and dioxin exposure through lactation were related to lower psychomotor scores at 7 months of age. At 84 months of age, effects of prenatal exposure to PCBs and dioxins on cognitive and motor abilities were found to be modified by parental and home characteristics. Longitudinal analyses of exposure on the development of cognitive and motor abilities showed a negative effect of prenatal exposure to PCBs on the level of cognitive and motor development from 3 to 84 months of age, and a comparable effect modification by parental and home environmental conditions. In 9-year-old children, negative effects of prenatal exposure to PCBs were seen on processing speed and sustained attention, Tower of London scores, and the cognitive event-related P300 latency. Tower of London scores were associated with the duration of breast-feeding, showing some evidence of a negative effect

of exposure to PCBs and dioxins through lactation. Supported in part by European Commission, EV5V-CT92-0207.

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#### **A. SEEBER, M. ZUPANIC, M. SCHÄPER, C. VAN THRIEL, & E. KIESSWETTER. Longitudinal Study on Neurobehavioral Effects of Long-Term Toluene Exposure.**

There is no doubt regarding the neurotoxic potency of the solvent toluene. According to findings with neurobehavioral methods, the occupational threshold limits of toluene were lowered over the last decades and are now fixed to 50 ppm in several European countries. However, an international debate arose on the possible neurobehavioral effects below this level. Occasional findings in cross sectional studies were interpreted as evidence for such adverse effects. A longitudinal study was performed to avoid shortcomings of the earlier studies. Employees ( $n = 192$ ) from 14 rotary printing plants with occupational toluene exposure were examined with neurobehavioral methods four times within five years. Attention, memory and psychomotor functions were measured with computerised test batteries. The employees were classified referring to high (45 ppm) and low (9 ppm) lifetime weighted average exposure (LWAE) and to long (21 years) and short (6 years) exposure duration. Age, education, carbohydrate-deficient transferrin (CDT) as an alcohol marker, and trait anxiety were included in statistical analyses. Repeated covariance analyses measures, which included all examination periods did not reveal significant differences between groups depending on the level and length of exposure. The retest reliability of the neurobehavioral tests was high and the performance trends across the four examinations were very similar in the different exposure groups. Education and primarily age were the dominating factors contributing to the variability of the data. Evidence for neurobehavioral performance deficits due to long-term exposure below 50 ppm could not be proved.

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**Symposium 18/11:00 a.m.-12:30 p.m.**

#### **MEMORY DEFICITS IN PSYCHIATRIC DISORDERS**

**Chairs: S. Lautenbacher and T. Beblo**

##### **S. LAUTENBACHER. Memory Deficits in Psychiatric Disorders.**

Psychopathology in psychiatric disorders is sometimes the direct result of dysfunctional memory formation as in the case of fear conditioning in phobia and of learned helplessness in depression. Sometimes memory deficits do not allow psychiatric patients to benefit from experiencing reality and to adjust perception and cognition as in the case of schizophrenia. Sometimes memory loss is simply a further symptom of a psychiatric disorder as in the case of drug abuse. Sometimes, psychopharmacological therapy aims at improving memory functions in psychiatric disorders; sometimes psychotherapy and patients' compliance is modulated by memory function. All these examples point to the fact that the understanding of memory is integral to the understanding of psychiatric disorders. This symposium tries to improve the understanding of both.

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##### **T. BEBLO, W. LANGE, C. BEREÄ, & M. DRIESSEN. Memory Functions in Borderline Personality Disorder.**

In contrast to the former notion, that patients with Borderline Personality Disorder (BPD) do not show deficits in standardized neuropsychological

tests, current research demonstrates deficits in declarative memory. There is some evidence that this impairment is not related to BDP itself but to comorbid psychiatric disorders like depression, dissociative disorders or Posttraumatic Stress Disorder (PTSD). The present study is addressed to the investigation of memory functioning in BPD and possible associations with comorbid psychiatric disorders. Twenty healthy volunteers and 20 BPD-patients will participate in the ongoing study. For the clinical diagnoses SKID I and II were conducted. To measure the severity of clinical symptoms, different self- and observer-rating scales were applied. Verbal and figural memory were assessed with the Wechsler Memory Scale-Revised (WMS-R), the Rey Complex-Figure Test, and the Auditory Verbal Learning Test. To control attention and executive functioning, corresponding neuropsychological tests were applied, too. The first results of this ongoing study demonstrate no overall memory disturbance but remarkable variations in test-outcomes in some patients. These extremely heterogeneous neuropsychological profiles are discussed in the context of dissociations and vigilance disturbances of the BPD-patients.

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#### **S. MORITZ, T.S. WOODWARD, & B. ANDRESEN. Memory Confidence and False Memories in Schizophrenia.**

In two recent studies (Moritz & Woodward (2002). *J Nerv Ment Dis*; Moritz et al. (2003). *Psychol Med*) we have attempted to extend previous research on source monitoring deficits in schizophrenia. Initially, it was hypothesized that patients experiencing auditory hallucinations would display a bias to attribute self-generated words to an external source. Further, it was expected that schizophrenic patients would be over-confident regarding false memories. For the monitoring task, subjects were instructed to provide a semantic association for 20 words. Subsequently, a list was read containing experimenter- and self-generated words as well as new words. The participant was required to identify each item as old/new, name the source, and state the degree of confidence for the source attribution judgment. No externalization bias for self-generated information was observed for hallucinatory patients. In both studies, schizophrenic subjects displayed an enhanced confidence for false responses. Patients committed more than 12% errors for responses they made with "high confidence", while the corresponding rate for controls was lower than 5%. We assume that healthy subjects attach some kind of "not trustworthy tags" to mental events that are not supported by sufficient evidence. It is inferred that a core cognitive deficit underlying schizophrenia is an overall failure to distinguish false from true amnesic contents. Currently, we are investigating the specificity of our findings and whether the inferred deficit manifests itself in other cognitive domains.

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#### **B. ANDRESEN, S. MORITZ, K.U. PETERSEN, P. ZAPLETALOVA, L. WARTBERG, & R. THOMASIU. Memory Decline in Former but Not in Actual Ecstasy (MDMA) Users, Compared to Non-Ecstasy Drug Users and Drug-Naïve Controls.**

MDMA ("ecstasy")—a synthetic "party drug" with neurotoxic potential for the serotonergic and possibly also the dopaminergic system (Ricaurte et al., 2002), has recently attracted much attention in more than 20 neuropsychological research studies on humans. The majority of these studies reported memory declines, preferentially in the verbal mode. The most intriguing problem in all these studies is the polytoxic drug usage especially of the ecstasy users, possibly leading to distorted results. The other major problem is the insufficient separation of neuropsychological effects during different time periods of abstinence. A third problem is given by pre-selection effects of drug users leading to artificial effects particularly in cross-sectional neuropsychological studies. Our current study tries to answer the question of whether memory decline can be verified specifically for MDMA users with two different abstinence durations (long: 20,

short: 20) compared to drug naïve controls (28) and poly-drug users without ecstasy use (20). Our results, based on ANOVA with three factors (drug groups, sex and education), ten memory, four executive and ten intelligence measures, are principally in line with the main findings in the literature indicating that verbal memory declines in polytoxic ecstasy users (compared to education-matched drug naïve controls) are found for short-term or delayed recall, but not working memory, executive functions and intelligence. Unexpectedly however, this poorer performance was only significant for former, but not for current/recent users. These differential results are found for drug groups with non-significant differences in cumulative amounts of non-ecstasy drug use (cannabis, cocaine, LSD, amphetamine, and psilocybin).

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#### **S. LAUTENBACHER, B. KUNDERMANN, J. SPERNAL, & J.-C. KRIEG. Explicit and Implicit Memory Functions in Major Depression: The Effect of Sleep Deprivation Therapy.**

Major depression (MD) is associated with dysfunctions in explicit memory whereas implicit memory appears unimpaired. Sleep deprivation (SD) might improve, because of its anti-depressive properties, cognition and in turn explicit memory. In contrast, growing evidence for the dependency of memory consolidation on certain sleep stages suggests a detrimental effect of SD. 14 inpatients with MD (DSM IV) were randomly assigned to 6 nights of total SD or 6 nights of undisturbed sleep over 3 weeks. All patients were also treated with behavioral therapy. Explicit (word-list learning) and implicit (repetition priming by a lexical decision task) memories were assessed for immediate effects just before and after SD or undisturbed sleep. In addition, in the morning delayed (overnight) effects were assessed for both memories. Depressive symptoms were assessed by the HAMD and self-rating scales. The HAMD scores decreased significantly in both treatment groups. SD produced repeatedly non-cumulative short-term effects on depressive symptoms. Surprisingly, only implicit memory appeared affected by SD. There was an overnight decrease of repetition priming after SD (but only during the first week of treatment) whereas patients with undisturbed night sleep showed stable priming effects over the whole period of 3 weeks. The parameters of explicit memory (delayed recall/recognition) were not affected by SD. Our data suggest that SD impairs preferentially the consolidation of implicit memory in MD whereas explicit memory functions are unaffected. The findings were discussed in the context of abnormalities in sleep stages in MD and their different involvement in memory storage.

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#### **K. FAST. Neuropsychological and Neurofunctional Correlates of Functional Amnesia.**

The term of "functional amnesia" is often used to indicate metabolic changes in brain regions contributing to memory processing, in the case of no clear identification of neither a psychogenic nor an organic cause. Functional amnesia often also deals with disorders of memory that seem to result from psychological trauma also referred to as psychogenic amnesia. An overview of both neuropsychological and neuroimaging results in functional amnesias will be given. The findings are discussed in terms of the theoretical, empirical, and methodological requirements of a laboratory model of functional amnesia and with respect to the idea of amnesic block syndrome as proposed by Markowitsch. In conclusion, the interactional and variable influence of organic and psychogenic-functional factors will be specified. Diagnostic necessities as well as therapeutic consequences will be proposed.

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Symposium 19/11:00 a.m.–12:30 p.m.

## NEUROPSYCHOLOGICAL STUDIES OF MEMORY IN ALZHEIMER'S DISEASE

Organizer and Chair: Patricia Montañés

### P. MONTAÑÉS. Neuropsychological Studies of Memory in Alzheimer's Disease.

The aim of this symposium is to present the results of neuropsychological studies realized in different populations of patients with Alzheimer's disease in a memory clinic in Bogotá-Colombia. All patients were submitted to a comprehensive study that includes a neurological, geriatric, psychiatric and neuropsychological protocol and imaging and laboratory studies. The 4 studies to be presented in the symposium have been realized in the last 3 years. Although episodic memory problems are the key signature of the disease, other types of memory are also involved from the beginning of the disease. In the first presentation, remote memory is explored in 30 patients, in a verbal recall and visual recognition task of people from our country that have been famous in the last decade (1988–1998). The second presentation relates to the description of the results obtained in a longitudinal study of 20 patients in a semantic memory task. The third presentation is also a longitudinal study of another 20 patients related to the analysis of the evolution of Anosognosia in Alzheimer's disease. The 3 studies have contributed to the discussion of the actual cognitive neuropsychological models to explain these deficits. In the last study, a new approach to the study of executive functions is proposed, with a qualitative analysis of the spontaneous verbal description of "one day" in the patient's life. Profiles of 20 AD patients elaborations is compared to those obtained in 7 patients with Fronto-Temporal dementia and 7 patients with Lewy body disease.

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### R. GARCÍA, P. MONTAÑÉS, D. MATAALLANA, C. CANO, & S. PLATA. Recall and Recognition of Famous Persons in Patients With Alzheimer's Disease.

Remote memory was studied in 30 patients (16 women and 14 men), ages 60 to 81 years and from 3 to 17 years of formal education, with probable Alzheimer's disease (AD) (NINCDS-ADRDA criteria, GDS = 3), and 30 paired controls. A verbal recall and a visual recognition task of personalities of the decade between 1988 and 1998 were created. Significant statistical differences were found in the group comparisons ( $p < .05$ ). The patient group presented a significant trend toward a temporal gradient for the people of the first years of the decade. This tendency was associated with time of evolution of the disease. Patients suffering with the disease for fewer years recalled and recognized better those people of the later years, while those who had suffered for more years performed better with those in the first years of the decade. The comparison between performance on the retrograde task and on the episodic task (list learning) was positively correlated with free and cued short term memory and cued long term memory, but negatively with false positives. None of the retrograde memory tasks correlated with free long term memory. The error analysis revealed that patients produced more semantic non-related errors (confabulation) and a marked tendency to generate false memories in the verbal recall task. Implications of the differences among memory and recognition, the temporary gradient, and the opposing correlation between retrograde and anterograde amnesia are discussed in light of traditional and current conceptions of memory loss in AD.

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### P. MONTAÑÉS, M.C. GOLDBLUM, D. MATAALLANA, C. CANO, S. PLATA, & C. TAMARA. Longitudinal Study of Semantic Memory in Alzheimer's Disease.

Semantic memory was studied in 20 patients (16 women and 4 men, ages 63 to 88 years and from 5 to 17 years of formal education), with probable Alzheimer's disease (AD) (NINCDS-ADRDA criteria, GDS = 3, mean MMS = 23), and 40 controls. The aim of this study was to establish the level of semantic processing of the patients in a naming task using black & white drawings, testing the Living- non-Living category and the visual complexity of the pictures. The longitudinal study of the 20 patients, conducted with at least a 7 month interval, in three occasions, allowed the study of the profile of evolution of semantic disorders and the evaluation of models proposed to explain the functional architecture of semantic memory. This study demonstrated the effects of variables that are controversial in the literature, such as category, familiarity and visual complexity in the semantic processing of the stimuli and the effect of evolution of the disease on the semantic representations. The heterogeneity in the semantic and neuropsychological profiles is emphasized and the analysis of subgroups of patients according to their profiles of deficits on verbal and constructional tasks is taken into account in the longitudinal analysis of semantic impairments and in the error analysis. The results obtained have contributed to the descriptions of semantic deficits in AD and to the analysis of hypothesis derived from models of cognitive neuropsychology.

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### A. MORENO, P. MONTAÑÉS, D. MATAALLANA, C. CANO, R. GARCÍA, & S. PLATA. Longitudinal Study of Anosognosia in Alzheimer's Disease.

The objective of this study was to examine in a longitudinal study, the presence of different dimensions of Anosognosia (cognitive, emotional and self-care abilities) in patients with probable Alzheimer's disease (AD) and the relation of Anosognosia to neuropsychological performance. Twenty patients with probable AD studied with 3 intervals of at least 7 months, were included, with a mean age of 75 years (range 57–91 years), 14 women and 4 men, diagnosed according to the NINCDS-ADRDA criteria, in a moderate stage of the disease (GDS 3–4, MMSE 15–28) and non-depressed (Yesavage < 5). All patients were studied at a Memory Clinic in Bogotá-Colombia, with a team approach, including a comprehensive neuropsychological assessment, completed with 3 questionnaires: The Subjective Memory Scale, Anosognosia Questionnaire and Patient Competency Rating Scale. Anosognosia was defined as the discrepancy between scores obtained by an informant and the patient. Although the discrepancies were significant on all scales, the differences between cognitive, emotional and self-care profiles were more pronounced in the cognitive domain. The correlations between the anosognosia scales and the neuropsychological data were significant for the levels of memory functions ( $p < .05$ ). An idiographic analysis was completed in representative cases in each of the domains, which demonstrated a high intra-subject variation. These results, in a homogeneous series of AD patients, link the presence of anosognosia to memory functions rather than frontal lobe disorders. Anosognosia is a very complex and multidimensional problem and the need for longitudinal studies of this phenomenon is emphasized in the discussion of the several existing models explaining this deficit.

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### D. MATAALLANA, C. CANO, C. SANTACRUZ, & R. GARCÍA. Architecture of Memory, Thought and Behavior in Patients With Alzheimer's Disease.

A great heterogeneity has been described in the cognitive profiles of AD patients. When the functional heterogeneity is interpreted as a cultural variable, an alternative procedure of testing is suggested. With a narrative description of a day in his/her life (present and past), we recorded routines and completed different analyses describing the thought architecture



and description of vital circumstances of 20 Alzheimer's disease (AD) patients, compared to 7 patients with fronto-temporal dementia (FTD) and 7 with Lewy Body disease (LB). Though all patients had severe impairment on classical thinking tasks (similarities and comprehension WAIS sub scales, WCST, etc.) patients with FTD and LB demonstrated differences in their thinking process when compared with Alzheimer's disease patients in terms of the memory component, course of thinking and sentence structure of their narrations. A qualitative analysis will be presented in order to comprehend the nature of the thinking and behavior architecture of this disease.

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## Paper Session 19/11:00 a.m.-12:30 p.m.

### NEUROPSYCHOLOGY II

**B.P. HERMANN, T. OYEGBILE, M. SEIDENBERG, R. HANSEN, V. MAGNOTTA, B. BELL, D. O'LEARY, A. WOODARD, P. RUTECKI, & R. SHETH. Cortical Surface Features in Localization-Related Temporal Lobe Epilepsy.**

Recent advances in quantitative MRI processing techniques have provided the means to examine several characteristics of cortical surface morphology including gyral and sulcal curvature, cortical depth and overall surface area. These advanced processing techniques were used to characterize the differences in cortical surface features between healthy controls and patients with temporal lobe epilepsy, determine whether greater than normal age-associated changes are evident in epilepsy, and document the clinical significance of individual differences in cortical surface features through their association with neuropsychological performance. Healthy controls ( $n = 46$ ) and patients with temporal lobe epilepsy ( $n = 48$ ), ranging in age from 14 to 59 years, underwent high-resolution quantitative volumetric imaging with advanced processing of cortical surface features including gyral and sulcal curvature, cortical depth, and total cortical surface area. There were significant ( $p < .05$ ) differences in cortical morphology between epilepsy patients and healthy controls, primarily on measures of gyrification, that were generalized in nature despite the lateralized and focal nature of the primary epileptic process. Reliable and robust changes in cortical surface features were associated with increasing chronological age in both healthy controls and patients with temporal lobe epilepsy, without evident of accelerated aging effects in epilepsy. Individual differences in gyrification were found to be of clinical significance as demonstrated by their significant association with a broad range of cognitive measures and relationship to other morphometric measurements (e.g., surface CSF). These core findings will be related to the larger literature regarding morphometric changes associated with temporal lobe epilepsy and normal aging.

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**L. MARSTRAND, A. GADE, G.W. HUMPHREYS, & H. UDESEN. Unilateral Infarcts in the Territory of the Posterior Cerebral Artery: A Prospective Study of Cognitive Deficits.**

Cognitive deficits associated with occipital lesions have been studied mainly in single cases and selected groups, and rarely in groups of well-defined consecutive patients defined by lesion. We included 53 consecutive patients with CT evidence of a pure unilateral infarct confined to the territory of the posterior cerebral artery in either hemisphere. The patients and a matched normal control group were assessed with tests of visual attention, form perception, visual analysis of degraded material, visual object recognition, face recognition, reading, color naming, memory, visuo-motor coordination, drawing, and motion perception. Deficits in visual analysis of degraded material were seen in 60–75% of the entire group, occurring equally often with infarcts in the left and right hemispheres, although patients with right hemisphere infarcts did score significantly lower on

two tests. Frequent deficits in the left hemisphere group on tests concerned with analysis of degraded material were unexpected based on e.g., Warrington and co-workers' model of visual object recognition. Deficits in visual object recognition (47%), face recognition (47%), and reading (43%) did not appear in strong association with one particular lesion side. No cases of severe visual object agnosia, alexia or prosopagnosia were observed in this series of unilateral cases.

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**M. WESTERVELD, A. COHEN, K. STODDARD, J. ALVAREZ-CARILLES, S. SPENCER, & D. SPENCER. Intracarotid Amytal Memory and Hippocampal Volume Measurements: Validity of the Wada as an Indicator of MRI Determined Hippocampal Atrophy.**

Selection of epilepsy patients who may benefit from temporal lobectomy involves several components, including identification of those who may be at risk for memory impairment. One method involves Intracarotid Amytal Testing ("Wada test") of hemispheric memory to determine functional adequacy and functional reserve of the ipsi and contralateral hippocampal formation, respectively. However, the validity of the Wada test has been criticized on several grounds, and in the face of improving functional imaging techniques, faces the prospect of obsolescence. One method of demonstrating validity is correlation of the Wada memory test with volumetric measurements of hippocampus in epilepsy surgery candidates. We retrospectively analyzed hippocampal volumetrics in 72 patients who underwent anteromedial temporal lobectomy for treatment of medically refractory epilepsy. The results indicate that there is a high degree of specificity in the correlation between hippocampal volume and memory performance. Right and left hippocampal volume measurements were not significantly correlated with one another ( $p > .10$ ). Similarly, right hemisphere memory (post-left injection) was not significantly related to left hemisphere memory ( $p > .10$ ). Right hemisphere memory was significantly correlated with right hippocampal volume ( $r = .51$ ;  $p < .0001$ ). Left hemisphere memory was significantly correlated with left hippocampal volume ( $r = .513$ ;  $p < .0001$ ). Both right and left hemisphere memory were correlated with hippocampal ratio ( $r = .466$ ;  $r = .448$ , respectively; both  $p < .001$ ). The results support the validity of the Wada memory test as a functional measure of the integrity of the hippocampus. Findings are discussed in terms of the continued value of Wada testing as part of the assessment of temporal lobectomy candidates.

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**A. J. LUNDERVOLD, A. LUNDERVOLD, H. NORDBY, K. SUNDET, S. ANDERSSON, A.-K. SOLBAKK, & I. REINVANG. Multi-Dimensional Measures of ERPs as Part of the Neuropsychological Assessment.**

Components from cognitive evoked potentials (ERPs) are highly relevant for understanding the processes underlying behaviour in an ongoing task. Multi-dimensional measures (MMN) has been used as an indicator of the functional state of the cortex and the early stage of automatic information processing. P3 is separated into a P3a component related to novelty detection and a P3b component related to processing of task relevant stimuli. The aim of the present study was to use data from both a neuropsychological and an ERP examination to evaluate the probability of brain dysfunction in individual patients. We present a multivariate analysis of latency and amplitude of the P3b and MMN components of ERP in a group of 88 normal subjects. All subjects were also assessed with a neuropsychological test battery. The Mahalanobis distance between each normal subject and the class mean on the four ERP measures was estimated, in order to establish a threshold value for later detection of "outliers" that might represent abnormal ERPs in patients. Results from patients were found to deviate with respect to the Mahalanobis distance measure. Together with results on two neuropsychological tests (CVLT learning and PASAT), the results strongly indicate brain dysfunction in these patients. We suggest that a multi-dimensional evaluation of ERPs should be used as part of the

neuropsychological evaluation of patients with a questionable brain dysfunction.

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**T.T. RIITA & R. HUHTA-HIRVONEN. The Later Cognitive Development After the Leukemia.**

In Tampere University Hospital, in 1990–1997, 55 children were diagnosed with ALL, who were in 1992–1999 in remission. In this group there were 42 children 1.5–7.5 years of age. The developmental level of the children was assessed at the beginning and at the end of the treatment received. Eighteen children received SR-, 16 children received MR-, and 8 children received HR-treatment. There were no significant differences in IQ scores between the risk groups when comparing the means before and after the treatment. The development of the 42 children was followed after the recovery. Six children relapsed and two of them died. Eight children were not reached. Information on the 28 children about their school achievement, learning disabilities, special education, remedial teaching, neuropsychological rehabilitation or other kinds of support needed was obtained. The developmental level of 20 children was assessed after 2–5 years after recovery. The results of the later cognitive development, the school achievement and the need for special support will be presented for the discussion. Correspondence: Tytti Riita, Tampere University Hospital, Pediatric Clinic, Box 2000, 33521 Tampere, Finland. E-mail: tytti.riita@pshp.fi

**E.H.F. DE HAAN, M.J.E. VAN ZANDVOORT, G. NYS, & N.F. RAMSEY. The Physiological Basis of Visual Hallucinations After Damage to the Primary Visual Cortex.**

This case report concerns a right-handed man who, at the age of 66 years, suffered an ischaemic episode resulting in several infarcted areas in the left and the right occipital cortex. He incurred a right-sided hemianopia, and he presented with mild memory problems. His main subjective complaint concerned frequently occurring positive visual experiences that ranged from simple shapes and colours that appeared in his blind field to complex visual hallucinations involving images of people and objects. The frequency of his hallucinations allowed us to investigate the physiological basis using fMRI. For image acquisition a PRESTO sequence was used, on a 1.5 T Philips scanner (2.4 s per scan, 26 slices, 4 mm isotropic voxels). During scanning he was asked to press a hand-held switch at beginning and end of each hallucination period. Scans acquired during hallucinations were compared to the baseline scans. In the primary visual cortex (V1) activity was found bilaterally during hallucinations. Bilateral activity was also observed with a checkerboard stimulation task, suggesting that both primary visual cortices were at least partially intact. Hallucination-related activity was observed adjacent to an infarcted area in the left visual cortex. These findings may reflect spontaneous activation in partially damaged tissue leading to positive visual experiences.

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